



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

118.48

117

KEY TO ADAMS'S NEW ARITHMETIC,
REVISED EDITION.

KEY

TO

ADAMS'S NEW ARITHMETIC,

REVISED EDITION.

FOR THE USE OF TEACHERS.

BY DANIEL ADAMS, M. D.,
AUTHOR OF THE SCHOLAR'S ARITHMETIC, SCHOOL GEOGRAPHY, ETC.

KEENE, N. H.:

PUBLISHED BY J. W. PRENTISS & CO.

BOSTON: PHILLIPS & RAMPSON. NEW-YORK: COLLINS & BROTHER.

AND FOR SALE BY BOOKSELLERS GENERALLY.

Edms T 118.48.117

Harvard College Library



**BOUGHT WITH MONEY
RECEIVED FROM THE
SALE OF DUPLICATES**



3 2044 096 994 520

Book of Proctor

Book

Northamptonfield
at

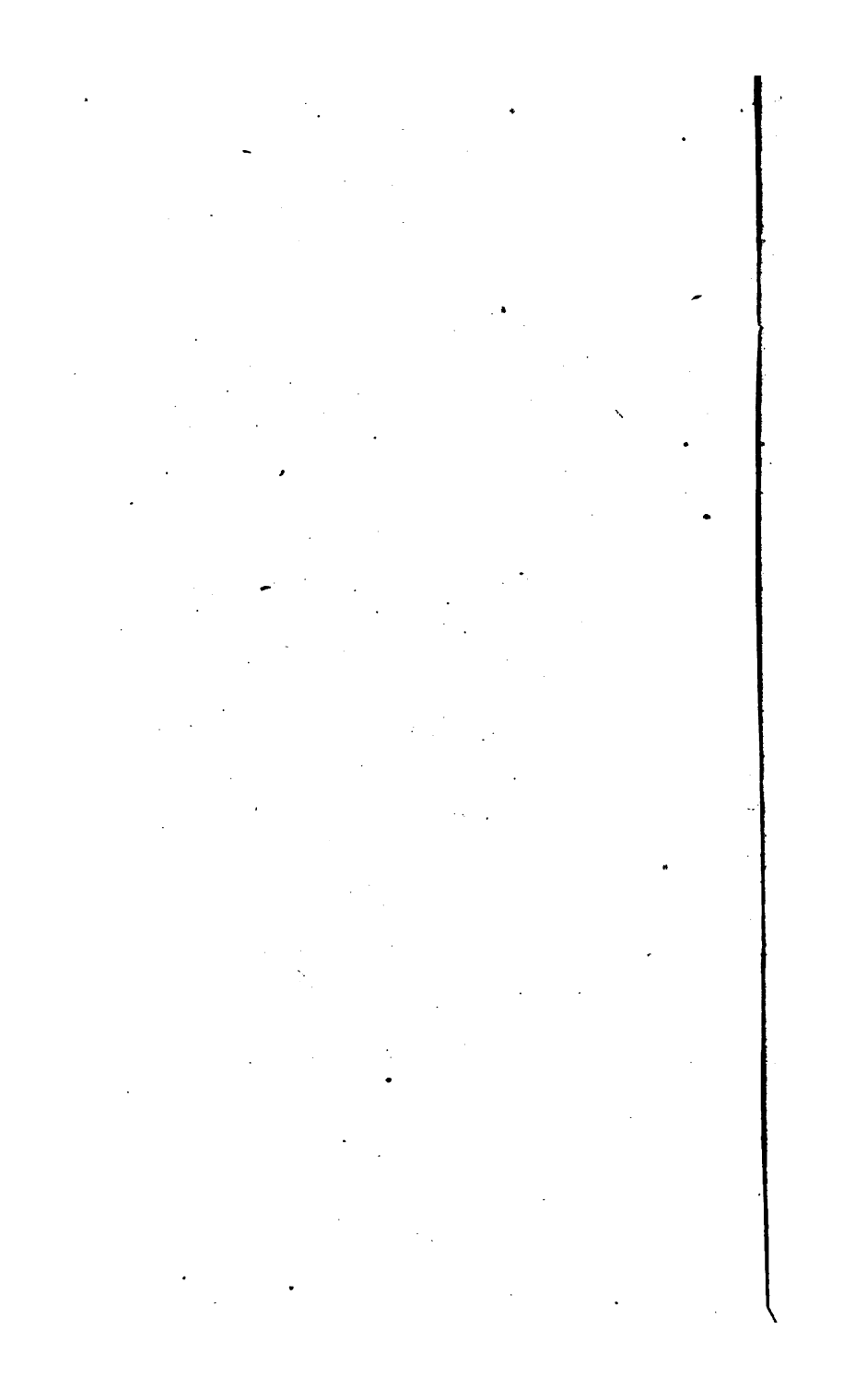
col. Post. J. Post

Post

Post

to





KEY

TO

ADAMS'S NEW ARITHMETIC,

REVISED EDITION.

FOR THE USE OF TEACHERS.

BY DANIEL ADAMS, M. D.,
AUTHOR OF THE SCHOLAR'S ARITHMETIC, SCHOOL GEOGRAPHY, ETC.



KEENE, N. H.:
PUBLISHED BY J. W. PRENTISS & CO.
BOSTON: PHILLIPS & SAMPSON. NEW-YORK: COLLINS & BROTHER.
AND FOR SALE BY BOOKSELLERS GENERALLY.

Edw T 118.48.117
✓



Duplicate money

Entered according to Act of Congress, in the year 1848, by
DANIEL ADAMS, M. D.
In the Clerk's Office of the District Court of the District of New Hampshire.

Stereotyped by
GEORGE A. CURTIS;
NEW ENGLAND TYPE AND STEREOTYPE FOUNDRY,
BOSTON.

KEY.

MULTIPLICATION OF SIMPLE NUMBERS.

¶ 29. Review of Multiplication.

EXERCISES.

1. $10700 \times 46 = 492200$ dollars taken, *Ans.*
2. $145 \times 2 = 290$, (families,) which $\times 6 = 1740$ inhabitants, *Ans.*
3. $46 \times 60 = 2760$ days' work, or men required, *Ans.*
4. $27 \times 6 = 162$, and $31 \times 6 = 186$; then, $162 + 186 = 348$ milés apart, *Ans.*
5. $4 \times 7 \times 6 \times 20 = 3360$, *Ans.*
6. $90 \times 18 = 1620$ days, *Ans.*
7. $115 \times 27 = 3105$ dollars, *Ans.*
8. $265 \times 89 = 23585$, *Ans.*
9. $9 \times 12 \times 14 = 1512$, *Ans.*
10. $346 \times 95 = 32870$ times, *Ans.*
11. $60 \times 40 = 2400$ seconds in 40 minutes, *Ans.*
12. $60 \times 60 = 3600$ seconds in an hour, and 3600×3 (the hours from 9 o'clock to 12) $= 10800$ seconds, *Ans.*
13. $275827 \times 19725 = 5440687575$, *Ans.*
14. $52 - 44 = 8$, which $\times 10 = 80$ miles, *Ans.*
15. $468 \times 6 = 2808$ cents, $48 \times 7 = 336$ cents, and $2808 + 336 = 3144$ cents, the value of the articles sold. $42 \times 9 = 378$ cents, $100 \times 6 = 600$ cents, $108 \times 10 = 1080$ cents, $12 \times 95 = 1140$ cents, and $378 + 600 + 1080 + 1140 = 3198$ cents, the value of the articles bought. Then $3198 - 3144 = 54$ cents, *Ans.*
16. $10 - 7 = 3$, and $3 \times 5 = 15$ cents, *Ans.*
17. $4 \times 5 \times 7 \times 6 \times 9 \times 8 \times 3 = 181440$, *Ans.*
18. $63 \times 8 = 504$ gallons in 8 hogsheads, and 504 gallons $\times 4 = 2016$ quarts, which $\times 2 = 4032$ pints, *Ans.*
19. $5 \times 3 \times 5 = 75$ the multiplier, and $118 \times 75 = 8850$ the product, *Ans.*
20. $77 \times 9 \times 4 \times 8 \times 5 = 110880$ privates; 42 army offi-

cers; $19 \times 5 = 95$ division officers; $25 \times 8 \times 5 = 1000$ brigade officers; $1 \times 4 \times 8 \times 5 = 1760$ regiment officers; $14 \times 9 \times 4 \times 8 \times 5 = 20160$ company officers; and $110880 + 42 + 95 + 1000 + 1760 + 20160 = 133937$ men, *Ans.*

- DIVISION OF SIMPLE NUMBERS.

¶ 39. When the divisor is a composite number.

EXAMPLES FOR PRACTICE.

2. $\frac{308}{7}$. $4 \times 7 = 28$; therefore, $308 \div 4 = 77$, and $77 \div 7 = 11$ days, *Ans.*

3. $\frac{576}{8}$. $8 \times 6 = 48$; therefore, $576 \div 8 = 72$, and $72 \div 6 = 12$ bushels each, *Ans.*

4. $\frac{1260}{7}$. $7 \times 9 = 63$; then, $1260 \div 7 = 180$, and $180 \div 9 = 20$, *Ans.*

5. $\frac{2430}{9}$. $9 \times 9 = 81$; $2430 \div 9 = 270$, which $\div 9 = 30$, *Ans.*

6. $\frac{448}{7}$. $7 \times 8 = 56$; $448 \div 7 = 64$, which $\div 8 = 8$, *Ans.*

¶ 40. EXAMPLES FOR PRACTICE.

3. $\frac{26406}{6}$. $6 \times 7 = 42$; $26406 \div 6 = 4401$, and $4401 \div 7 = 629$ and 5 remainder, which $\times 6$, the first divisor, = 30, *Ans.*

4. $\frac{64923}{3}$. $3 \times 4 \times 8 = 96$; $64923 \div 3 = 21607$ and 2 rem.; then $21607 \div 4 = 5401$ and 3 rem., and $5401 \div 8 = 675$ and 1 rem. Then $1 \times 4 \times 3 = 12$; $3 \times 3 = 9$, and $12 + 9 + 2 = 23$, *Ans.*

5. $\frac{6811}{9}$. $9 \times 9 = 81$; $6811 \div 9 = 756$ and 7 rem.; $756 \div 9 = 84$, and $84 \div 7 = 12$, *Ans.*

6. $\frac{26487}{7}$. 1st, $3 \times 4 \times 8 = 96$, 3d rem.; $7 \times 4 \times 3 = 84$, 2d rem.; $1 \times 3 = 3$, and $84 + 3 = 87$, true rem. 2d, $8 \times 4 \times 3 = 96$, 3d rem.; $2 \times 4 \times 8 = 64$, 2d rem.; $2 \times 8 = 16$, and $64 + 16 + 7 = 87$, true rem. 3d, $4 \times 3 \times 8 = 96$, 3d rem.; $7 \times 3 \times 4 = 84$, and $84 + 3 = 87$, true rem. *Ans.* 26487.

¶ 43. Review of Division.

EXERCISES.

1. $15 \overline{) 26250}$; then, $26250 \div 15 = 1750$ dollars, *Ans.*

2. $18950 \div 25 = 758$ men, *Ans.*

3. $7412 \div 34 = 218$ in a basket, *Ans.*
4. $505710 \div 135 = 3746$, *Ans.*
5. $95,000,000 \div 8 = 11,875,000$ miles a minute, *Ans.*
6. $2760 \div 120 = 23$ men to dig it in 120 days, *Ans.*
7. $32870 \div 95 = 346$ times in running 1 mile, *Ans.*
8. $2419200 \div 60 = 40320$ minutes, *Ans.*
9. $525960 \div 60 = 8766$ hours, *Ans.*
10. $8766 \div 24 = 365\frac{6}{4} = 365$ days, 6 hours, *Ans.*
11. $480 \div 48 = 10$ times, *Ans.*
12. $47854 \div 3478 = 13\frac{649}{3478} = 13$ times and a remainder of 2640, *Ans.*
13. $32 \div 8 = 4$ quarts, *Ans.*

MISCELLANEOUS EXERCISES.

¶ 44. 12. $13^a = 68$, $2^a = 14$, and $68 + 14 = 82$, the greater number; then $68 - 14 = 54$, the less number, *Ans.*

¶ 45. 7. $525 \div 5 = 105$, which $\div 7 = 15$, *Ans.*

¶ 46. 1. $13 \times 15 = 195$ cents, *Ans.*

2. $195 \div 15 = 13$ cents, *Ans.*

3. $195 \div 13 = 15$ pounds, *Ans.*

4. $75 \times 984 = 73800$ cents, which $\div 100 = 738$ dollars, *Ans.*

5. 738 dollars $\times 100 = 73800$ cents, and $73800 \div 984 = 75$ cents, *Ans.*

7. $28400 \div 648 = 43\frac{116}{648}$ cents, *Ans.*

¶ 47. 1. $8 \times 4 = 32$, $32 \times 2 = 64$, $64 - 34 = 30$, and $30 + 10 = 40$ apples, *Ans.*

2. $64 \times 3 = 192$, $192 \div 8 = 24$, $24 + 7 = 31$, and $31 - 4 = 27$, *Ans.*

3. $365 \times 6 = 2190$ cents saved in 1 year, and $2190 \times 45 = 98550$ cents saved in 45 years; 12 dollars = 1200 cents, the cost of 1 cow; then $98550 \div 1200 = 82\frac{150}{1200}$, that is 82 cows, and a remainder of 1 dollar and 50 cents, *Ans.*

4. $12480 \div 20 = 624$, and $624 \times 2 = 1248$ acres bought; then $22464 \div 1248 = 18$ dollars, the cost per acre, *Ans.*

6. 25 (pounds of tea) $\times 42 = 1050$, and $1050 \div 15 = 70$ pounds of butter, *Ans.*

7. $23 + 14 = 37$, age of the father when his wife died; $37 - 12 = 25$, his age when his daughter was born; and $25 - 5 = 20$, his age when his daughter's husband was born; then $20 + 40 = 60$ years old at his death, *Ans.*

8. $68000 \times 24 = 1632000$ miles in 1 day; $1632000 \times 365 = 595680000$ miles in 1 year, which $\div 40 = 14892000$ days, and this $\div 365 = 40800$ years, *Ans.*

MEASUREMENT OF RECTANGLES AND SOLIDS.

¶ 48. 2. $160 \times 8 = 1280$ square rods, *Ans.*

4. $8 \times 7 = 56$, $6 \times 5 = 30$, and $56 + 30 = 86$ yards, *Ans.*

5. $16 \times 15 = 240$, and $240 + 12 = 252$ feet, *Ans.*

6. $6 \times 5 = 30$, and $30 - 3 = 27$ yards, *Ans.*

¶ 49. 2. $1280 \div 8 = 160$ rods, *Ans.*

3. $736 \div 23 = 32$ feet, *Ans.*

¶ 50. 2. $1280 \div 160 = 8$ rods, *Ans.*

3. $13392 \div 186 = 72$ rods, *Ans.*

¶ 51. 2. $27 \times 21 \times 6 = 3402$ solid feet, *Ans.*

3. $28 \times 14 \times 8 = 3136$ solid feet, *Ans.*

¶ 52. 2. $\frac{3402}{27 \times 21}$. $27 \times 21 = 567$, and $3402 \div 567 = 6$ feet, *Ans.*

3. $\frac{3136}{28 \times 14}$. $28 \times 14 = 392$, and $3136 \div 392 = 8$ feet, *Ans.*

4. $\frac{360}{4 \times 6}$. $4 \times 6 = 24$, and $360 \div 24 = 15$ feet, *Ans.*

5. $\frac{6864}{78 \times 8}$. $78 \times 8 = 624$, and $6864 \div 624 = 11$ inches, *Ans.*

¶ 53. 1. $84 \div 14 = 6$ rows of squares, *Ans.*

2. $9500 \div 76 = 125$ squares in a row, *Ans.*

3. $96 = 96 \times 1 = 48 \times 2 = 32 \times 3 = 24 \times 4 = 16 \times 6 = 12 \times 8$; as no other two factors will produce 96, the figure can be varied in 6 ways, *Ans.*

4. 40 feet (the length of 1 side) \times 4 (the number of sides) $=$ 160 feet (the length of all the sides;) 160 feet (the length) \times 18 feet (the height) $=$ 2880 square feet, the super-

ficial contents, $+6$ feet waste $= 2886$ square feet of boards;
and $2886 \div 13$ (the number of square feet in 1 board) $=$
222 boards, *Ans.*

5. 29 feet (the width) $- 2$ feet (the space) $= 27$ feet;
 $36 \times 27 = 972$ square feet, the space occupied by the tables.
 $3 \times 3 = 9$ square feet, the space occupied by 1 table, and
 $972 \div 9 = 108$ tables, *Ans.*

¶ 60. CANCELATION.

$$4. \frac{\overset{5}{35} \times 5 \times \overset{4}{4} \times \overset{3}{8} \times 3}{3 \times \overset{2}{7} \times 2 \times \overset{2}{15}} = \frac{80}{3} = 26\frac{2}{3} \text{ acres, } \textit{Ans.}$$

$$5. \frac{\overset{2}{36} \times 8 \times \overset{6}{4} \times 8 \times 2}{6 \times 5 \times 3 \times 4 \times 2} = \frac{128}{5} = 25\frac{3}{5}, \textit{ Ans.}$$

$$6. \frac{\overset{9}{27} \times \overset{2}{11} \times \overset{8}{40} \times 8 \times \overset{2}{6}}{\overset{5}{7} \times \overset{4}{10} \times \overset{5}{12} \times \overset{2}{15}} = \frac{288}{5} = 57\frac{3}{5}, \textit{ Ans.}$$

$$7. \frac{4 \times 7 \times \overset{3}{18} \times 10 \times 8 \times 9}{\overset{3}{24} \times \overset{4}{12} \times 3} = \frac{70}{1} = 70, \textit{ Ans.}$$

$$8. \frac{14 \times \overset{3}{5} \times 3 \times 23}{\overset{3}{15} \times 9} = \frac{392}{9} = 43\frac{5}{9}, \textit{ Ans.}$$

¶ 61. To find a common divisor of two or more numbers.

2. $4 = 4 \times 1$, $16 = 4 \times 4$, $24 = 4 \times 6$, $36 = 4 \times 9$, and
 $8 = 4 \times 2$; the common factor, 4, is the common divisor,
Ans.

3. $22 = 11 \times 2 = 22 \times 1$, $44 = 11 \times 4 = 22 \times 2$, $66 =$
 $11 \times 6 = 22 \times 3$, and $88 = 11 \times 8 = 22 \times 4$; the common
divisor may be 11 or 22, *Ans.*

4. The length of the rod will be equal to the common
measure of the lengths of the two pieces of cloth. $25 = 5 \times$
 5 , and $30 = 5 \times 6$; the length of the rod will be 5 feet, *Ans.*

¶ 62. To find the greatest common divisor of two or more numbers.

1. $35 \div 21 = 1$ and 14 rem.; $21 \div 14 = 1$ and 7 rem.; and $14 \div 7 = 2$; the greatest common divisor is 7, *Ans.*

2. $544 \div 96 = 5$ and 64 rem.; $96 \div 64 = 1$ and 32 rem.; and $64 \div 32 = 2$; the greatest common divisor is 32, *Ans.*

3. $1181 \div 468 = 2$ and 245 rem.; $468 \div 245 = 1$ and 220 rem.; $245 \div 220 = 1$ and 25 rem.; $220 \div 25 = 7$ and 24 rem.; $25 \div 24 = 1$ and 1 rem., and $24 \div 1 = 24$; the greatest common divisor is 1, *Ans.*

4. $80 \div 32 = 2$ and 16 rem.; $32 \div 16 = 2$; $256 \div 16 = 16$; the greatest common divisor is 16, *Ans.*

5. $200 \div 75 = 2$ and 50 rem.; $75 \div 50 = 1$ and 25 rem.; $50 \div 25 = 2$; $625 \div 25 = 25$; $150 \div 25 = 6$; the greatest common divisor is 25, *Ans.*

6. The length of the chain will be equal to the greatest common divisor of the length and width of the field. $160 \div 100 = 1$ and 60 rem.; $100 \div 60 = 1$ and 40 rem.; $60 \div 40 = 1$ and 20 rem., and $40 \div 20 = 2$; the length of the chain is 20 rods, *Ans.*

7. The price per acre is equal to the greatest common divisor of all their sums of money. $2640 \div 1680 = 1$ and 960 rem.; $1680 \div 960 = 1$ and 720 rem.; $960 \div 720 = 1$ and 240 rem.; $720 \div 240 = 3$; $756 \div 240 = 3$ and 36 rem.; $240 \div 36 = 6$ and 24 rem.; $36 \div 24 = 1$ and 12 rem.; $24 \div 12 = 2$. They paid 12 dollars per acre; and A bought $\frac{2640}{12} = 220$ acres, B bought $\frac{1680}{12} = 140$ acres, and C bought $\frac{756}{12} = 63$ acres, *Ans.*

COMMON FRACTIONS.

¶ 66. EXAMPLES FOR PRACTICE.

11. $\frac{83}{6} = 83 \div 6 = 13\frac{5}{6}$ dollars, *Ans.*

12. $13 = \frac{13}{1}$, and $\frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$ of a dollar, *Ans.*

13. $\frac{1407}{60} = 1407 \div 60 = 23\frac{27}{60}$ hours, *Ans.*

14. $23 = \frac{23}{1}$, and $\frac{1}{60} + \frac{1}{60} = \frac{2}{60} = \frac{1}{30}$ of an hour, *Ans.*

16. $730 = \frac{730}{1}$, which $\div \frac{1}{12} = \frac{730}{12} = 60\frac{5}{6}$ of a shilling, *Ans.*

18. $156 = \frac{156}{1}$, which $\div \frac{1}{12} = \frac{156}{12} = 13$ of a day, *Ans.*

19. $\frac{1371}{4} = 1371 \div 4 = 342\frac{3}{4}$ gallons, *Ans.*

21. $\frac{36}{5} = 1\frac{6}{5}$, $\frac{106}{40} = 2\frac{11}{10}$, $\frac{87}{100} = 0\frac{87}{100}$, $\frac{4788}{1000} = 4\frac{788}{1000}$, and $\frac{3465}{150} = 23\frac{11}{10}$.

22. $1 = \frac{1}{1}$, which $\div \frac{1}{6} = \frac{1}{6}$; $17 = \frac{17}{1}$, which $\div \frac{1}{6} = 102$.

$\frac{70}{1000} = \frac{7}{100}$; $8 = \frac{800}{100}$, which $+$ $\frac{70}{1000} = \frac{870}{1000}$; $4 = \frac{4000}{1000}$, which $+$ $\frac{70}{1000} = \frac{4700}{1000}$; and $7 = \frac{7000}{1000}$, which $+$ $\frac{70}{1000} = \frac{7700}{1000}$.

¶ 67. EXAMPLES FOR PRACTICE.

2. $6)\frac{1}{100} = 2)\frac{2}{100} = 13)\frac{13}{100} = \frac{1}{10}$, *Ans.*
 3. $100)\frac{1}{1000} = \frac{1}{10}$; $5)\frac{1}{1000} = 3)\frac{3}{1000} = \frac{1}{100}$; &c.
 4. $450)\frac{1}{1000} = \frac{1}{450}$; $99)\frac{99}{997} = \frac{1}{99}$; $20)\frac{1}{100} = \frac{1}{20}$; $548)\frac{1}{1000} = \frac{1}{548}$
 $= \frac{1}{4}$.
 6. $57)\frac{1}{100} = \frac{1}{57}$, *Ans.*
 8. $1429)\frac{1}{1000} = \frac{1}{1429}$, *Ans.*

ADDITION AND SUBTRACTION OF FRACTIONS.

¶ 70. EXAMPLES.

2. Each term of $\frac{1}{2}$ multiplied by $3 \times 8 \times 5 = \frac{120}{240}$
 " " " $\frac{1}{3}$ " " $2 \times 8 \times 5 = \frac{80}{160}$
 " " " $\frac{1}{8}$ " " $2 \times 3 \times 5 = \frac{30}{60}$ } *Ans.*
 " " " $\frac{1}{5}$ " " $2 \times 3 \times 8 = \frac{48}{240}$
 3. Each term of $\frac{1}{5}$ multiplied by $5 \times 4 = \frac{20}{20}$.
 " " " $\frac{1}{3}$ " " $3 \times 4 = \frac{12}{12}$.
 " " " $\frac{1}{4}$ " " $3 \times 5 = \frac{15}{15}$.
 And $\frac{20}{20} + \frac{12}{12} + \frac{15}{15} = \frac{71}{10} = 1\frac{1}{10}$, *Ans.*
 4. $\frac{1}{4}$ (multiplying both terms by 7) $= \frac{7}{28}$, and $\frac{1}{7} (\times 4) = \frac{4}{28}$; then, $\frac{7}{28} + \frac{4}{28} = \frac{11}{28} = 1\frac{1}{28}$, *Ans.*
 5. Each term of $\frac{1}{2}$ multiplied by $3 \times 7 \times 5 = \frac{105}{210}$.
 " " " $\frac{1}{3}$ " " $2 \times 7 \times 5 = \frac{70}{140}$.
 " " " $\frac{1}{7}$ " " $2 \times 3 \times 5 = \frac{30}{60}$.
 " " " $\frac{1}{5}$ " " $2 \times 3 \times 7 = \frac{42}{84}$.
 Then $\frac{105}{210} + \frac{70}{210} + \frac{30}{210} + \frac{42}{210} = \frac{247}{210} = 1\frac{17}{210}$, *Ans.*
 6. $\frac{1}{4}$ (multiplying both terms by 6) $= \frac{3}{12}$, and $\frac{1}{6} (\times 4) = \frac{2}{12}$; or $\frac{3}{12} + \frac{2}{12} = \frac{5}{12}$, and $\frac{1}{6} (\times 2) = \frac{1}{3}$, *Ans.*

¶ 72. NOTE. The least common multiple of two or more numbers, is the least number which contains all the prime factors of those numbers. Hence, to find the least common multiple, or common denominator, of two or more numbers, it is simply necessary to resolve those numbers into their prime factors, by dividing them continually and successively, by the primes, 2, 3, 5, 7, 11, 13, &c., until the last quotients terminate in units. The product of all the prime divisors will be the least common multiple.

2)	2	4	6	8	10
2)	1	2	3	4	5
2)	1	1	3	2	5
3)	1	1	3	1	5
5)	1	1	1	1	5
	1	1	1	1	1

We may take Ex. 1 of the Arithmetic for an illustration. Find the least common denominator of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{7}$. The prime divisors, $2 \times 2 \times 2 \times 3 \times 5 = 120$, *Ans.*

- ¶ 76. 2. $90 \times \frac{1}{2} = \frac{90}{2} = 45$, *Ans.*
 3. $369 \times \frac{2}{3} = (369 \div 3 = 123, \text{ and } 123 \times 2 =) 246$, *Ans.*
 4. $45 \times \frac{7}{10} = (45 \times 7 = 315, \text{ and } 315 \div 10 =) 31\frac{1}{2}$, *Ans.*
 5. $210 \times \frac{9}{10} = \frac{210 \times 9}{10} = 189$, *Ans.*
 6. $1326 \times \frac{2}{11} = \frac{1326 \times 2}{11} = 241\frac{4}{11}$, *Ans.*

¶ 77. EXAMPLES FOR PRACTICE.

2. $1367 \times \frac{2}{3}$. $\frac{2}{3}$ of $1367 = 911\frac{1}{3}$, and $\frac{2}{3} = 911\frac{1}{3} \times 2 = 1822\frac{2}{3}$ dollars, *Ans.*
 3. $225 \times 1\frac{1}{3}$. $1\frac{1}{3}$ of $225 = 281\frac{1}{3}$, and $1\frac{1}{3} = 281\frac{1}{3} \times 11 = 3094\frac{1}{3}$ dollars, *Ans.*

¶ 78. EXAMPLES FOR PRACTICE.

2. $\frac{7}{8} \times \frac{9}{10} = \frac{63}{80} = \frac{7}{10}$, *Ans.* $\frac{9}{10} \times \frac{7}{8} = \frac{63}{80} = \frac{7}{10}$, *Ans.*
 3. $\frac{9}{10} \times \frac{7}{8} = \frac{63}{80} = \frac{7}{10}$ of a dollar, *Ans.*
 5. $7\frac{1}{2} = \frac{15}{2}$; then $\frac{15}{2} \times \frac{3}{4} = \frac{45}{8} = 5\frac{5}{8}$ dollars, *Ans.*
 6. $2\frac{1}{4} \times 6\frac{3}{8} = \frac{9}{4} \times \frac{51}{8} = \frac{459}{32} = 14\frac{27}{32}$ dollars, *Ans.*

- ¶ 79. 2. $\frac{2}{3}$ of $\frac{7}{8} = \frac{7}{12}$. $\frac{7}{12}$ of $\frac{2}{3} = \frac{7}{18}$. $\frac{1}{2}$ of $\frac{7}{18} = \frac{7}{36}$, *Ans.*

4. $\frac{5}{12}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{8}{9} = \frac{5 \times 2 \times 3 \times 8}{12 \times 3 \times 4 \times 9} = \frac{5}{27}$, *Ans.*
 5. $\frac{4}{5}$ of $\frac{2}{3}$ of $\frac{7}{8}$ of $\frac{3}{4} = \frac{4 \times 2 \times 7 \times 3}{5 \times 3 \times 8 \times 4} = \frac{7}{25}$, *Ans.*

¶ 80. EXAMPLES FOR PRACTICE IN CANCELATION.

2. $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{6}{7}$ of $\frac{5}{6}$ of $\frac{9}{10}$ of $\frac{7}{8}$ of $\frac{8}{9} = \frac{3}{10}$, *Ans.*
 3. $\frac{7}{1} \times \frac{1}{2} \times \frac{5}{7}$ of $\frac{3}{8} \times \frac{28}{9} = \frac{35}{12} = 2\frac{7}{12}$, *Ans.*
 4. $\frac{3}{1} \times \frac{2}{5} \times \frac{5}{9}$ of $\frac{3}{4} \times (2\frac{1}{2}) = \frac{19}{7} \times \frac{11}{12}$ of $\frac{6}{7}$ of $\frac{4}{5} = 2\frac{22}{25}$, *Ans.*
 5. $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{6}{7}$ of $\frac{5}{6}$ of $\frac{199}{9} = \frac{199}{21} = 9\frac{10}{21}$, *Ans.*
 6. $\frac{6}{7}$ of $\frac{1}{3}$ of $\frac{8}{1} = \frac{16}{7} = 2\frac{2}{7}$ tons, *Ans.*
 7. $\frac{7}{8}$ of $\frac{3}{4}$ of $\frac{6}{7}$ of $\frac{5}{6}$ of $\frac{8}{9}$ of $\frac{1}{1} = \frac{1}{12}$, *Ans.*

¶ 80. (2.) PROMISCUOUS EXAMPLES IN THE MULTIPLICATION OF FRACTIONS.

3. $2\frac{2}{5} (= \frac{12}{5}) \times 3 = \frac{36}{5} = 8\frac{1}{5}$ tons, or (multiplying the integers and the fraction separately) $2 \times 3 = 6$, and $\frac{2}{5} \times 3 = \frac{6}{5} = 1\frac{1}{5}$; then, $2\frac{2}{5} + 6 = 8\frac{1}{5}$ tons, &c.

4. 3 dollars $\times 8\frac{1}{2} = 25\frac{1}{2}$ dollars, *Ans.*

5. $14\frac{3}{4}$ dollars $\times 147 = 2168\frac{1}{4}$ dollars, *Ans.*

6. 1000 dollars $\times \frac{3}{5}$ ($\div 5 = 200$ dollars, or $\frac{1}{5}$, which $\times 3 = 600$ dollars, or $\frac{3}{5}$, which is A's share; 1000 dollars $\times (\frac{2}{5} =) \frac{2}{5}$ ($\div 5$, &c., as before) $= 400$ dollars, which is B's share.

7. $\frac{1}{2}$ of $\frac{2}{3} = \frac{1}{3}$, $\frac{3}{4}$ of $\frac{4}{5} = \frac{3}{5}$, and $\frac{1}{2} \times \frac{3}{5} = \frac{1}{5}$, *Ans.*; or, $\frac{1}{2}$ of $\frac{2}{3} \times \frac{3}{4}$ of $\frac{4}{5} = \frac{1}{5}$, *Ans.*, as before.

12. $\frac{1}{9}$ of $\frac{8}{1} = \frac{8}{9}$, $\frac{2}{3}$ of $\frac{7}{1} = \frac{14}{3}$, $\frac{3}{8}$ of $\frac{9}{1} = \frac{27}{8}$, and $\frac{1}{7}$ of $\frac{10}{1} = \frac{10}{7}$; then, $\frac{8}{9} \times \frac{14}{3} \times \frac{27}{8} \times \frac{10}{7} = 20$, *Ans.*; or, $\frac{1}{9}$ of $\frac{8}{1} \times \frac{2}{3}$ of $\frac{7}{1} \times \frac{3}{8}$ of $\frac{9}{1} \times \frac{1}{7}$ of $\frac{10}{1} = 20$, *Ans.*, as before.

DIVISION OF FRACTIONS.

¶ 81. EXAMPLES FOR PRACTICE.

9. $\frac{1}{20} \div 24 = \frac{1}{480}$ of an acre, *Ans.*

10. $\frac{1}{11} \div 12 = \frac{1}{132}$ of a dollar, *Ans.*

12. $\frac{1}{10} \div 12 = \frac{1}{120} = \frac{1}{30}$, *Ans.* $\frac{1}{5} \div 21 = \frac{1}{105} = \frac{1}{120}$, *Ans.* $\frac{1}{3} \div 24 = \frac{1}{72} = \frac{1}{8}$, *Ans.*

14. $(4\frac{1}{2} =) \frac{9}{2} \div 9 = \frac{1}{2}$ of a dollar, *Ans.*

15. $(12\frac{1}{2} =) \frac{25}{2} \div 5 = \frac{5}{2} = 2\frac{1}{2}$, *Ans.*

16. $(14\frac{3}{4} =) \frac{59}{4} \div 8 = \frac{59}{32} = 1\frac{27}{32}$, *Ans.*

18. $2786\frac{1}{2} \div 6 = 464$, and $2\frac{1}{2}$ remain. $= \frac{1}{2} \div 6 = \frac{1}{12} = \frac{1}{12}$; then, $464 + \frac{1}{12} = 464\frac{1}{12}$, *Ans.*

19. $7646\frac{1}{2} \div 24 = 318$, rem. $14\frac{1}{2} = \frac{29}{2} \div 24 = \frac{29}{48}$; then, $318 + \frac{29}{48} = 318\frac{29}{48}$, *Ans.*

20. $462\frac{1}{2} \div 3 = 154\frac{1}{6}$, *Ans.*

¶ 82. EXAMPLES FOR PRACTICE.

2. $7 \div \frac{1}{2} = (7 \times 2 = 14, \text{ which } \div 1 =) 14 \text{ times, } Ans.$
3. $26 \div \frac{1}{4} = 104 \text{ times, } Ans.$
4. $3 \div \frac{3}{4} = (3 \times 4 = 12, \text{ which } \div 3 =) 4; 6 \div \frac{3}{4} = 9;$
 $10 \div \frac{3}{4} = 25, Ans.$
5. $(3 \text{ gal.} =) 12 \text{ quarts } \div \frac{9}{16} = (12 \times 16 = 192, \text{ which } \div 9 =) 21\frac{1}{3} \text{ days, } Ans.$
6. $22 \div (2\frac{1}{4} =) \frac{1}{4} = (22 \times 4 = 88, \text{ which } \div 11 =) 8$
 acres, *Ans.*
7. $6 \div \frac{36}{5} = (\times 5 \text{ and } \div 36 =) \frac{5}{3} \text{ of 1 time, } Ans.$
8. $53 \div (8\frac{1}{2} =) \frac{17}{2} = (\times 9 \text{ and } \div 77 =) 6\frac{1}{2} \text{ times, } Ans.$

¶ 83. EXAMPLES FOR PRACTICE.

2. $37 \div (4\frac{1}{2} =) \frac{22}{5} = (\times 5 \text{ and } \div 22 =) 8\frac{1}{2} \text{ yards, } Ans.$
3. $84 \div \frac{906}{103} = (\times 103 \text{ and } \div 96 =) 90\frac{1}{2} \text{ pounds, } Ans.$
4. $87 \div \frac{5}{8} = 104\frac{2}{5} \text{ rods, } Ans.$

¶ 84. EXAMPLES FOR PRACTICE.

4. $(36\frac{1}{4} =) \frac{225}{4} \div (4\frac{1}{2} =) \frac{23}{5} (\frac{5}{23} \text{ of } \frac{225}{4}) = \frac{1475}{184} = 8\frac{3}{184}$
 weeks, *Ans.*
5. $(2\frac{1}{4} =) \frac{9}{4} \div (1\frac{1}{2} =) \frac{3}{2} = \frac{3}{2} \times \frac{2}{3} = 1\frac{1}{2}, Ans.; (10\frac{2}{3} =) \frac{32}{3}$
 $\div (2\frac{1}{6} =) \frac{17}{6} = \frac{32}{3} \times \frac{6}{17} = 4\frac{1}{17}, Ans.$
6. $\frac{3}{5} \div \frac{1}{10} (\frac{10}{3} \text{ of } \frac{3}{5}) = \frac{20}{5} = 4, Ans.$
7. $(4\frac{1}{5} =) \frac{21}{5} \div \frac{3}{7} (\frac{7}{3} \text{ of } \frac{21}{5}) = \frac{273}{5} = 11\frac{3}{5}, Ans.$
8. $(\frac{2}{3} \text{ of } \frac{3}{4} = \frac{1}{2} =) \frac{1}{2} \div (\frac{1}{5} \text{ of } \frac{7}{8} = \frac{7}{40} =) \frac{1}{2} (\frac{40}{7} \text{ of } \frac{1}{2}) = \frac{20}{7}$
 $= 4, Ans.; \text{ or, } \frac{2}{3} \text{ of } \frac{3}{4} \div \frac{7}{8} \text{ of } \frac{1}{7} = (\frac{2}{3} \text{ of } \frac{3}{4} \times \frac{8}{7} \text{ of } \frac{1}{7}) = 4, Ans.,$
 as before.

¶ 85. EXAMPLES FOR PRACTICE.

2. $\frac{7}{8} \div (3\frac{1}{2} =) \frac{7}{2} = (\frac{7}{8} \times \frac{2}{7} =) \frac{1}{4} \text{ of a dollar, } Ans.$
3. $\frac{7}{8} \text{ of a dollar } \div (4\frac{1}{2} =) \frac{14}{3} = (\frac{7}{8} \times \frac{3}{14} =) \frac{3}{16} \text{ of a dol-}$
 lar, *Ans.*

T 85. (2.) EXAMPLES FOR PRACTICE.

3. $(7\frac{1}{5} =) \frac{36}{5} \div \frac{3}{9} = (\frac{36}{5} \times \frac{9}{3} =) \frac{108}{5} = 21\frac{3}{5}, \text{ Ans.}$
4. $(6\frac{2}{3} =) \frac{57}{9} \div \frac{1}{3} = (\frac{57}{9} \times \frac{3}{1} =) 19, \text{ Ans.}$
5. $(3\frac{1}{2} =) 2\frac{1}{2} + 9 = (2\frac{1}{2} \times \frac{1}{2} =) 2\frac{1}{2}, \text{ Ans.}$
6. $\frac{7}{12} \div (4\frac{2}{3} =) 2\frac{2}{3} = (\frac{7}{12} \times \frac{3}{2} =) 2\frac{1}{2}, \text{ Ans.}$
7. $(7\frac{1}{8} =) 12\frac{1}{8} \div (9\frac{1}{2} =) 2\frac{1}{2} = (12\frac{1}{8} \times \frac{2}{5} =) 4\frac{1}{4}, \text{ Ans.}$
8. $10 \div \frac{3}{8} = (\times 8 \text{ and } \div 3 =) \frac{80}{3} = 26\frac{2}{3}, \text{ Ans.}$
9. $5 \div (7\frac{2}{3} =) 2\frac{2}{3} = (\times 3 \text{ and } \div 23 =) \frac{1}{23}, \text{ Ans.}$
10. $\frac{5}{24} \div 16 = \frac{5}{384} = \frac{1}{768}, \text{ Ans.}$
11. $\frac{2}{3} \text{ of } \frac{4}{5} \text{ of } \frac{9}{1} = \frac{24}{5}, (3\frac{1}{10} =) \frac{31}{10} \times (2\frac{1}{2} =) \frac{5}{2} = 2\frac{5}{10};$
 then, $\frac{24}{5} \div \frac{259}{30} = (\frac{24}{5} \times \frac{30}{259} =) 2\frac{14}{259}, \text{ Ans.}$

T 85. (3.) PROMISCUOUS EXAMPLES IN THE DIVISION OF FRACTIONS.

NOTE. In the first six of the following examples, let the pupil consult TT 77, 83, and 85, and make the several distinctions.

1. $\frac{68}{100}$ of a dollar (cost) $\div 7$ (lb., the quantity) $= \frac{18}{25}$ of a dollar, the price of unity, or 1 lb., *Ans.*
2. $\frac{1}{3}$ of a dollar (cost) $\div \frac{2}{3}$ (of a barrel, the quantity) $= \frac{1}{2}$ of $\frac{1}{3} =) \frac{1}{6}$ of a dollar, the price of unity, or 1 barrel, *Ans.*
3. $\frac{7}{8}$ of a dollar $\div 4 = \frac{7}{32}$ of a dollar, *Ans.*
4. 4 dollars $\div \frac{7}{8}$ (of a yard) $= 4\frac{4}{7}$ dollars, *Ans.*
5. 75 dollars $\div (14\frac{2}{3} =) 1\frac{1}{3} = (\times 8 \text{ and } \div 115) = 5\frac{2}{5}$ dollars, *Ans.*
6. $(31\frac{1}{2} =) 2\frac{1}{2}$ of a dollar $\div (10\frac{1}{2} =) 2\frac{1}{2} (\frac{2}{21} \text{ of } \frac{63}{2}) = 3$ dollars per barrel, *Ans.*
8. $(\frac{1}{2} \text{ of } \frac{2}{3} =) \frac{1}{3} \div \frac{3}{4} (\frac{4}{3} \text{ of } \frac{1}{3} =) \frac{4}{9}; \frac{7}{8} \div (\frac{4}{7} \text{ of } \frac{2}{5} =) \frac{8}{35}$
 $\frac{35}{8} \text{ of } \frac{7}{8} = \frac{245}{64} = 3\frac{13}{64}, \text{ Ans.}$

9. $(\frac{1}{2} \text{ of } \frac{4}{5} =) \frac{2}{5} \div (\frac{5}{3} \text{ of } \frac{2}{3} =) \frac{5}{9} (\frac{9}{5} \text{ of } \frac{2}{5} =) \frac{2}{3}, \text{ Ans.}$
10. $(\frac{1}{5} \text{ of } \frac{4}{1} =) \frac{4}{5} \div \frac{4}{15} (\frac{15}{4} \text{ of } \frac{4}{5} =) 3, \text{ Ans.}$
11. $(4\frac{1}{2} =) \frac{41}{9} \div (\frac{5}{9} \text{ of } \frac{4}{1} =) \frac{20}{9} (\frac{9}{20} \text{ of } \frac{41}{9} =) 2\frac{1}{10}, \text{ Ans.}$
12. $(\frac{5}{9} \text{ of } \frac{4}{1} =) \frac{20}{9} \div (4\frac{1}{2} =) \frac{41}{9} (\frac{9}{41} \text{ of } \frac{20}{9} =) \frac{20}{41}, \text{ Ans.}$
13. $(8\frac{2}{7} =) \frac{58}{7} \div (9\frac{2}{5} =) \frac{47}{5} = (\frac{58}{7} \times \frac{5}{47} \times) \frac{290}{47}; \frac{2}{7} \div 7$
 $= \frac{2}{21}; \text{ then } \frac{295}{329} \div \frac{2}{21} = (\frac{295}{329} \times \frac{21}{2} =) \frac{885}{94} = 9\frac{33}{94}, \text{ Ans.}$

¶ 86. REVIEW OF COMMON FRACTIONS.

EXERCISES.

1. $\frac{5}{8} + \frac{3}{8} = \frac{40+18}{48} = \frac{58}{48} = 1\frac{1}{4}, \text{ Ans. } \frac{1}{2} \times \frac{2}{3} = \frac{2+2}{6} = \frac{4}{6}, \text{ Ans.}$
 $(12\frac{1}{2} =) 12\frac{6}{12} + (3\frac{2}{3} =) 3\frac{8}{12} + (4\frac{3}{4} =) 4\frac{9}{12} = 20\frac{11}{12}, \text{ Ans.}$
2. $\frac{1}{2} - \frac{1}{8} = \frac{2-1}{8} = \frac{1}{8}, \text{ Ans. } \frac{3}{10} - \frac{1}{5} = \frac{3-2}{10} = \frac{1}{10}, \text{ Ans.}$
 $\frac{1}{4} - \frac{1}{8} = \frac{2-1}{8} = \frac{1}{8}, \text{ Ans. } (14\frac{1}{2} =) 14\frac{7}{14} - (4\frac{1}{2} =) 4\frac{2}{4} = 10\frac{5}{4}, \text{ Ans. } 6 - 4\frac{3}{8} = 1\frac{5}{8}, \text{ Ans. } 11\frac{2}{3} - (\frac{1}{2} \text{ of } \frac{2}{3} \text{ of } \frac{3}{4} =) \frac{1}{4} = \frac{218-55}{220} = \frac{163}{220}, \text{ Ans.}$
3. $\frac{5}{8} - \frac{2}{8} = \frac{25-12}{80} = \frac{13}{80}, \text{ Ans.}$
4. $\frac{3}{5} + \frac{1}{5} = \frac{24+5}{40} = \frac{29}{40}, \text{ Ans.}$
5. $21 \times \frac{3}{4} = 15\frac{3}{4}, \text{ Ans.}$
6. $\frac{1}{2} \div \frac{2}{3} = (\frac{1}{2} \times \frac{3}{2} =) \frac{3}{4}, \text{ Ans.}$
7. 12 must be the remaining $\frac{2}{5}$ of the number. $12 \div 3 = 4 = \text{one fifth of the number, which } \times 5 = 20, \text{ Ans.}$
8. $(\frac{2}{5} \text{ of } \frac{5}{3} \text{ of } 1 =) \frac{2}{3} + \frac{3}{3} = \frac{5}{3}; 20 \text{ is } \frac{5}{3} \text{ of the number.}$
 $20 \div 5 = 4 = \text{one third of the number, which } \times 3 = 12, \text{ Ans.}$
9. $9 \div 2 = 4\frac{1}{2} = \text{one third of the number, which } \times 3 = 13\frac{1}{2}, \text{ Ans.}$
10. $\frac{3}{4}$ of 1 yard will cost $\frac{3}{4}$ of $\frac{1}{3}$ of a dollar $= \frac{1}{4}$ of a dollar, *Ans.*

11. $(59 = 7 \frac{1}{2} \times (18 \frac{1}{2} =) \frac{37}{2} = 1 \frac{5}{11} \frac{17}{11} = 108 \frac{5}{11}$ dollars, *Ans.*
 12. $\frac{3}{2} \times 84 = 2 \frac{1}{2} \frac{2}{2} = 11 \frac{5}{11}$ dollars, *Ans.*
 13. $\frac{1}{2} \times 45 = 2 \frac{1}{2} \frac{1}{2} = 28 \frac{1}{2}$ dollars, *Ans.*
 14. $5 \times \frac{7}{15} = 2 \frac{1}{3}$ dollars, *Ans.*
 15. $\frac{1}{15} \div \frac{1}{6} = (\frac{1}{15} \times \frac{6}{1} =) \frac{2}{5}$ of a dollar, *Ans.*
 16. $(73 \frac{1}{2} =) \frac{369}{2} \div (7 \frac{1}{2} =) \frac{36}{5} = (\frac{369}{5} \times \frac{5}{36} =) \frac{41}{4} = 10 \frac{1}{4}$ dollars, *Ans.*
 17. $82 \frac{2}{3} \div 4 = 20$, and $2 \frac{2}{3} = 1 \frac{1}{3}$ remain., which $\div 4 = \frac{1}{4}$; then, $20 + \frac{1}{4} = 20 \frac{1}{4}$ dollars, *Ans.*
 18. $\frac{5}{12} \div 3 \frac{1}{2} = (\frac{5}{12} \times \frac{2}{7} =) \frac{5}{42}$ of a dollar, *Ans.*
 19. $4 \frac{1}{3} \div \frac{3}{20} = \frac{35}{8} \times \frac{20}{3} = \frac{175}{6} = 29 \frac{1}{6}$ pounds, *Ans.*
 20. $82 \frac{1}{4} \div 1 \frac{1}{2} = 3 \frac{1}{2} \times \frac{2}{1} = 16 \frac{1}{2} = 59 \frac{3}{4}$ bushels, *Ans.*
 21. $8 \frac{1}{4} \times 9 = 78 \frac{1}{4}$ yards in 9 dresses; then $80 - 78 \frac{1}{4} = 1 \frac{1}{4}$ yards in the remnant, *Ans.*
 22. $22 = 176$ eighths, which $\div 7$ eighths $= 25$, and 1 remainder, which is $\frac{1}{8}$ of a yard. *Ans.*, 25 vests. Remnant, $\frac{1}{8}$ of a yard.
 23. $\frac{3}{4} \div 15 = \frac{3}{60} = \frac{1}{20}$, *Ans.*
 24. $\frac{2}{8}$ of $\frac{7}{40} = \frac{1}{40}$, which $\div 7 = \frac{1}{40}$; $6 \div (3 \frac{1}{4} =) \frac{37}{11} = \frac{6}{1}$
 $\times \frac{11}{37} = \frac{66}{37}$; then, $\frac{1}{40} \times \frac{66}{37} = \frac{33}{740}$, *Ans.*
 25. $72 = 2 \times 2 \times 2 \times 3 \times 3$.
 $8 = 2 \times 2 \times 2$, all the factors are factors of 72.
 $9 = 3 \times 3$, " " " " " "
 $11 = 11 \times 1$, " " " not " " "
 $12 = 2 \times 2 \times 3$, " " " are " " "
 $14 = 2 \times 7$, " " " not " " "
 $15 = 3 \times 5$, " " " " " " "
 $16 = 2 \times 2 \times 2 \times 2$, " " " " " " "
 $18 = 2 \times 3 \times 3$, " " " are " " "
 $20 = 2 \times 2 \times 5$, " " " not " " "
 $22 = 2 \times 11$, " " " " " " "
 $24 = 2 \times 2 \times 2 \times 3$, " " " are " " "
Ans., 8, 9, 12, 18, 24.

$$\begin{aligned}
 26. \quad \frac{3}{4} \text{ of } 9\frac{1}{2} &= \frac{3}{4} \text{ of } \frac{29}{2} = \frac{29}{4}, \frac{8}{11} \text{ of } 16 = \frac{128}{11}, \text{ and } \frac{29}{4} \div \frac{128}{11} \\
 &= \frac{29}{4} \times \frac{11}{128} = \frac{319}{512}; \frac{2}{6} \text{ of } \frac{1}{3} \text{ of } (2\frac{1}{2}) = \frac{5}{2} = \frac{5}{18}, \frac{1}{4} \text{ of } (19\frac{1}{2}) \\
 &= \frac{39}{2} = \frac{39}{8}, \text{ and } \frac{5}{18} \div \frac{39}{8} = \frac{5}{18} \times \frac{8}{39} = \frac{20}{351}; \text{ then, } \frac{319}{512} \div \frac{20}{351} \\
 &= \frac{319}{512} \times \frac{351}{20} = \frac{111969}{10240} = 10\frac{2569}{10240}, \text{ Ans.}
 \end{aligned}$$

DECIMAL FRACTIONS.

¶ 92. EXAMPLES FOR PRACTICE.

$$\begin{aligned}
 6. \quad \frac{47\frac{1}{2}}{162} &= '496 +; \frac{1^{\circ}}{367} = '0272 +; \frac{16^{\circ}}{8888} = '00186 +. \\
 7. \quad \frac{4}{3} &= '444 +; \frac{5}{99} = '0505 +; \frac{8}{999} = '008008 +; \frac{1}{3} \\
 &= '333 +; \frac{2}{3} = '6666 +; \frac{1}{11} = '090909 +; \frac{1}{11} = '3636 \\
 &+; \frac{1}{999} = '00110011 +. \\
 8. \quad \frac{1}{2} &= '125; \frac{3}{8} = '375; \frac{5}{8} = '625; \frac{1}{2} = '2; \frac{2}{3} = '4; \frac{3}{5} \\
 &= '6; \frac{4}{5} = '8; \frac{1}{20} = '05; \frac{1}{25} = '04; \frac{1}{75} = '04.
 \end{aligned}$$

Addition and Subtraction of Decimal Fractions.

¶ 95. EXAMPLES FOR PRACTICE.

$$\begin{aligned}
 3. \quad 13\cdot25 + 8\cdot4 + 23\cdot051 + 6 + '75 &= 51\cdot451 \text{ bushels,} \\
 \text{Ans.} \\
 4. \quad 429 + 21\cdot37 + 355\cdot003 + 1\cdot07 + 1\cdot7 &= 808\cdot143, \text{ Ans.} \\
 5. \quad '2 + '80 + '089 + '006 + '9 + '005 &= 2, \text{ Ans.} \\
 6. \quad 329\cdot7 + 37\cdot162 + '16 &= 367\cdot022, \text{ Ans.} \\
 7. \quad 35000 - '035 &= 34999\cdot965, \text{ Rem.} \\
 12. \quad 29\cdot3 + 374\cdot000009 + 97\cdot253 + 315\cdot004 + 27 + 100\cdot4 \\
 &= 942\cdot957009, \text{ Ans.}
 \end{aligned}$$

Examples in Addition and Subtraction of Federal Money.

$$\begin{aligned}
 1. \quad \$6\cdot75 + \$2\cdot30 + \$\cdot92 + \$1\cdot25 + \$\cdot06 &= \$10\cdot15\frac{1}{2}, \\
 \text{Ans.} \\
 2. \quad \$237\cdot62 + \$350 + \$86\cdot125 + \$9\cdot625 + \$834 &= \\
 \$684\cdot204, \text{ Ans.} \\
 3. \quad \$300 + \$50\cdot60 + \$9\cdot08 &= \$359\cdot68, \text{ Ans.}
 \end{aligned}$$

$$4. \$56.18 + \$7.375 + \$280 + \$287 + \$17 + \$90.413 = \$451.255, \text{ Ans.}$$

$$5. \$76.50 + \$85 + \$17.25 = \$178.75, \text{ Ans.}$$

$$6. \$28 + \$375 + \$24 + \$11 + \$1.625 + \$06 + \$04 = \$13.62, \text{ Ans.}$$

$$7. \$21.375 - \$18 = \$3.37\frac{1}{2}, \text{ Ans.}$$

$$8. \$82.00 - \$79.75 = \$2.25, \text{ loss, Ans.}$$

$$9. \$176.00 - \$16.50 = \$159.50, \text{ Ans.}$$

$$10. \$5400.000 - \$725.375 = \$4674.62\frac{1}{2}, \text{ Ans.}$$

$$11. \$500.00 - \$83 = \$499.17, \text{ Ans.}$$

$$12. \$1200.00 - \$800.35 = \$399.65, \text{ Ans.}$$

$$13. \$7.000 - \$0.005 = \$6.995, \text{ Ans.}$$

$$14. \$25.00 - \$16.82 = \$8.18, \text{ Ans.}$$

$$15. \$250.00 - \$87.14 = \$162.86, \text{ Ans.}$$

$$16. \$6.25 + \$1.41 = \$7.66, \text{ cost of the articles purchased; then, } \$10.00 - \$7.66 = \$2.34, \text{ Ans.}$$

MULTIPLICATION OF DECIMAL FRACTIONS.

¶ 96. EXAMPLES FOR PRACTICE.

$$3. .05 \times .007 = .00035, \text{ Ans.}$$

$$5. 3672 \times .85 = 3121.2, \text{ Ans.}$$

$$6. .37 \times .0563 = .020831, \text{ Ans.}$$

$$8. 86 \times .04 = 3.44, \text{ Ans.}$$

$$9. .0062 \times .0003 = .00000496, \text{ Ans.}$$

$$10. 4.7 \times 10.86 = 51.042, \text{ Ans.}$$

$$\text{¶ 97. } 1. \$09 \times .7 = \$063, \text{ Ans.}$$

$$2. \$885 \times 250 = \$221.25, \text{ Ans.}$$

$$3. \$6.375 \times 87 = \$554.62\frac{1}{2}, \text{ Ans.}$$

$$4. \$285 \times 63 = \$17.95\frac{1}{2}, \text{ Ans.}$$

$$5. \$125 \times 365 = \$45.62\frac{1}{2}, \text{ which } \times 5 = \$228.12\frac{1}{2}, \text{ Ans.}$$

$$6. \$36.75 \times 17800 = \$654150, \text{ Ans.}$$

$$7. \$367 \times 46 = \$16892, \text{ Ans.}$$

$$8. \$273 \times 8600 = \$2347.80, \text{ Ans.}$$

$$11. \$11 \times .13 = \$1.43, \text{ Ans.}$$

$$12. \$2 \times .375 = \$75, \text{ Ans.}$$

$$13. \$75 \times 6 = \$4.50, \text{ which } \times 4 = \$18, \text{ Ans.}$$

DIVISION OF DECIMAL FRACTIONS.

¶98. EXAMPLES FOR PRACTICE.

5. $3156\cdot293 \div 25\cdot17 = 125\cdot3 +$, *Ans.*
6. $173948 \div \cdot375 = 463861 +$, *Ans.*
7. $5737 \div 13\cdot3 = 431\cdot353 +$, *Ans.*
8. $2464\cdot8 \div \cdot008 = 308100$, *Ans.*
9. $2\cdot0000 \div 53\cdot1 = \cdot037 +$, *Quot.*
10. $\cdot0120 \div \cdot005 = 2\cdot4$, *Ans.*
11. $\cdot003 \div \cdot04 = \cdot075$, *Ans.*
12. $8\cdot6 \div \cdot094 = 91\cdot439 +$, *Ans.*
13. $8 \div \cdot17 = 47 +$, *Ans.*

- ¶99. 2. $\$141\cdot00 \div \$\cdot75 \left(14\frac{1}{5}\right) = 158$ bushels, *Ans.*
3. $\$37\cdot000 \div \$\cdot125 \left(2\frac{2}{5}\right) = 296$ pounds, *Ans.*
 4. $\$8\cdot0000 \div \$\cdot00625 \left(\frac{8}{125}\right) = 128$ oranges, *Ans.*
 5. $\$5\cdot000 \div \cdot6 = \$8\cdot333 +$, *Ans.*
 6. $\$468\cdot75 \div 750 \left(1\frac{1}{5}\right) = \$0\cdot625$, *Ans.*
 7. $\$181\cdot25 \div 125 \left(1\frac{1}{5}\right) = \$1\cdot45$, *Ans.*
 8. $\$1913\cdot52 \div 536 \left(1\frac{1}{5}\right) = \$3\cdot57$, *Ans.*
 9. $\$3213 \div 84 \left(3\frac{1}{4}\right) = \$38\cdot25$, *Ans.*

¶100. Review of Decimal Fractions.

EXERCISES.

2. $(7\frac{3}{10} =) 7\cdot3$ yds. $+ (12\frac{5}{8} =) 12\cdot625$ yds. $= 19\cdot925$ yds.; then, $(36\frac{5}{8} =) 36\cdot625$ yds. $- 19\cdot925$ yds. $= 16\cdot7$ yds., *Ans.*
3. $\$33\frac{1}{3} = \$33\cdot8461 +$, $\$14\frac{2}{5} = \$14\cdot40$, $\$7\frac{1}{2} = \$7\cdot5555 +$, $\$8\frac{1}{2} = \$8\cdot333 +$; then, $\$33\cdot8461 + \$14\cdot40 + \$7\cdot5555 + \$8\cdot333 = \$56\cdot634 +$, *Ans.*
4. $\$125 \times 37\cdot75 = \$4\cdot718\frac{3}{4}$, *Ans.*
5. $\$17\cdot37 \times 11\cdot625$ tons $= \$201\cdot92\frac{5}{8}$, *Ans.*
6. $\$201\cdot92625 \div 11\cdot625 = \$17\cdot37$, *Ans.*
7. $\$9 \div \cdot45$ ton $= \$20$, *Ans.*
8. $\$0\cdot4 \times \cdot25$ gal. $= \$1$, *Ans.*
9. $\$0\cdot07 \times 2300 = \$16\cdot10$, *Ans.*
10. $\$18 \times 765\cdot5 = \$137\cdot79$, *Ans.*
11. $\$165$ (price of 1 pound) $\times 42$ (the number of pounds in a firkin) $= \$6\cdot93$, cost of 1 firkin, which $\times 23$ (the number of firkins) $= \$159\cdot39$, cost of 23 firkins, *Ans.*
12.
$$\begin{array}{r} 129 + 129 \text{ lbs. at } \$\cdot05 = \$12\cdot90 \\ 123 + 125 \text{ " " } \cdot045 = 11\cdot16 \\ 163 \text{ " " } \cdot07 = 11\cdot41 \end{array} \} \$35\cdot47, \text{ } \textit{Ans.}$$

13. Dr.	25 lbs. clover seed, at \$'11,	\$2'75
	3 pecks herds grass seed,	2'25
	1 barrel flour,	6'50
	13 lbs. sugar, at \$'12½,	1'62½
		<u>\$13'12½</u>
Cr.	3 Cheeses, 27 lbs. each, at \$'08½,	\$6'88½
	5 barrels cider, at \$1'25,	6'25
		<u>\$13'13½</u>

balance for the farmer, *Ans.*

14. $\$71600 - \$39876'74 = \$31723'26$, which $\div 7 = \$4531'89 +$, *Ans.*

15. $\$87 \times 100 = \$87'00$, which $\div \$'25 = 348$ pounds, *Ans.*

16. $126 \text{ pounds} \times 3 = 378 \text{ pounds}$; then, $\$125 \times 378 = \$47'25$, *Ans.*

17. $\$86'75 \times 650 = \$56387'50$, *Ans.*

18. $\$0625 \times 275 = \$17'1875$, which $\div \$'50 = 34'375$ bushels, *Ans.*

19. $\$9'32 \times 18 = \$167'76$, which $\div \$4'66 = 36$ yards, *Ans.*

20. $\$3'75 \times 16 = \60 ; $\$4'50 \times 21 = \$94'50$; $\$5,12½ \times 35 = \$179'37½$; then, $\$60 + \$94'50 + \$179'37½ = \$333'87½$, *Ans.*

REDUCTION OF COMPOUND NUMBERS.

¶ 105. EXAMPLES FOR PRACTICE.

3. $32\text{£. } 15\text{s.} = 655\text{s.}$, which $+ 8\text{d.} = 7868\text{d.} = 31472\text{qrs.}$, *Ans.*

4. *Reverse the foregoing process*; thus, $31472 \text{ qrs.} = 7868\text{d.} = 655\text{s.} + 8\text{d.}$, and $655\text{s.} = 32\text{£.} + 15\text{s.}$, together making $32\text{£. } 15\text{s. } 8\text{d.}$, *Ans.* So in the following examples.

5. $7\text{£. } 14\text{s.} = 154\text{s.}$, which $+ 6\text{d.} = 1854\text{d.}$, and $1854\text{d.} + 1\text{q.} = 7417\text{qrs.}$, *Ans.*

6. $7417\text{qrs.} = 1854\text{d.} + 1\text{q.}$, $1854\text{d.} = 154\text{s.} + 6\text{d.}$, and $154\text{s.} = 7\text{£. } 14\text{s.}$, together making $7\text{£. } 14\text{s. } 6\text{d. } 1\text{q.}$, *Ans.*

7. $91\text{£. } 11\text{s.} = 1831\text{s.}$, which $+ 3\text{d.} = 21975\text{d.}$, and $21975\text{d.} + 2\text{qrs.} = 87902\text{qrs.}$, *Ans.*

10. $9752\text{d.} = 812\text{s.} + 8\text{d.}$, and $812\text{s.} = 40\text{£. } 12\text{s.}$, together making $40\text{£. } 12\text{s. } 8\text{d.}$, *Ans.*

11. 1£. 18s. = 38s., which + 4d. = 460d., and 460d. + $\frac{1}{2}$ d. = 921 half pence, *Ans.*

12. 921 half pence = 460d. + $\frac{1}{2}$ d., 460d. = 38s. + 4d., and 38s. = 1£. 18s., together making 1£. 18s. $\frac{1}{2}$ d., *Ans.*

¶ 106. EXAMPLES FOR PRACTICE.

3. 7 T. = 14000 lbs., which + 665 lbs. = 14665 lbs., *Ans.*

5. 12 T. 15 cwt. = 255 cwt., 255 cwt. + 1 qr. = 1021 qrs., 1021 qrs. + 19 lbs. = 28607 lbs., which + 6 oz. = 457718 oz., and 457718 oz. + 12 drs. = 7323500 drs., *Ans.*

6. 7323500 drs. = 457718 oz. + 12 drs., 457718 oz. = 28607 lbs. + 6 oz., 28607 lbs. = 1021 qrs. + 19 lbs., 1021 qrs. = 255 cwt. + 1 qr., and 255 cwt. = 12 T. 15 cwt., together making 12 T. 15 cwt. 1 qr. 19 lbs. 6 oz. 12 drs., *Ans.*

7. 5 T. 9 cwt. = 109 cwt., which = 436 qrs.; and 436 qrs. + 12 lbs. = 12220 lbs.; then, 12220 lbs. \div 26 (the number of lbs. in a package) = 470 packages, *Ans.*

¶ 107. EXAMPLES FOR PRACTICE.

3. 7 lbs. 11 oz. = 95 oz., which + 3 pwt. = 1903 pwt.; and 1903 pwt. + 9 grs. = 45681 grs., *Ans.*

6. 5605 grs. = 233 pwt. + 13 grs., and 233 pwt. = 11 oz. + 13 pwt., together making 11 oz. 13 pwt. 13 grs., *Ans.*

7. 28 lbs \times 7000 = 193000 grs. Troy; 196000 grs. = 8166 pwt. 16 grs.; 8166 pwt. = 408 oz. 6 pwt., 408 oz. = 34 lbs.; whence, 34 lbs. 6 pwt. 16 grs., *Ans.*

8. 34 lbs. = 408 oz., which + 6 pwt. = 8166 pwt., and 8166 pwt. + 16 grs. = 196000 grs. Troy; then, 196000 grs. \div 7000 = 28 lbs. Avoirdupois weight, *Ans.*

¶ 108. EXAMPLES FOR PRACTICE.

1. 9 lbs. 8 $\frac{3}{4}$ = 116 $\frac{3}{4}$, 116 $\frac{3}{4}$ + 1 $\frac{3}{4}$ = 929 $\frac{3}{4}$, which + 2 \eth = 2789 \eth , and 2789 \eth + 19 grs. = 55799 grs., *Ans.*

2. 55799 grs. = 2789 \eth 19 grs., 2789 \eth = 929 $\frac{3}{4}$ 2 \eth , 929 $\frac{3}{4}$ = 116 $\frac{3}{4}$ 1 $\frac{3}{4}$, and 116 $\frac{3}{4}$ = 9 lb. 8 $\frac{3}{4}$; whence, 9 lb. 8 $\frac{3}{4}$ 1 $\frac{3}{4}$ 2 \eth 19 grs., *Ans.*

¶ 109. EXAMPLES FOR PRACTICE.

1. 360 deg. = 24900 mi. = 7963000 rds. = 131472000 ft. = 1577664000 in., *Ans.*

4. 30539520 in. = 2544960 ft. = 154240 rds. = 482 mi., *Ans.*

5. The circumference of the wheel being 16 ft. 6 in., (= 1 rod,) it will turn round as many times as there are rods in 40 miles. 40 mi. = 12800 rds.; whence, 12800 times, *Ans.*

7. 43 mi. = 13760 rds. = 227040 ft. = 2724480 in.; and 2 ft. 6 in. = 30 in.; then, 2724480 in. ÷ 30 in. = 90816 times = 90816 steps, *Ans.*

8. (2 ft. 6 in. =) 30 in. × 90816 = 2724480 in. = 227040 ft. = 13760 rds. = 43 mi., *Ans.*

¶ 110. EXAMPLES FOR PRACTICE.

1. 573 yds. 1 qr. = 2293 qrs., which ÷ 1 na. = 9173 na., *Ans.*

4. 5932 na. = 1483 qrs. = 296 E. E. 3 qrs., *Ans.*

5. 151 E. E. = 755 qrs. = 188 yds. 3 qrs., *Ans.*

7. 36 E. Fl. × 29 = 1044 E. Fl. = 3132 qrs. = 783 yds., *Ans.*

¶ 111. EXAMPLES FOR PRACTICE.

1. 17 A. 3 R. = 71 R., which ÷ 12 P. = 2852 P. = 776457 sq. ft., *Ans.*

2. 776457 sq. ft. = 2852 P. = 71 R. 12 P., and 71 R. = 17 A. 3 R.; whence, 17 A. 3 R. 12 P., *Ans.*

3. 64 M. = 40960 A. = 6553600 P. = 1784217600 sq. ft., *Ans.*

5. $6 \times 6 = 36$ M. = 23040 A., *Ans.*

7. 197663000 M. = 126504320000 A. = 20240691200000 P. = 5510528179200000 sq. ft., *Ans.*

¶ 112. EXAMPLES FOR PRACTICE.

1. 5 mi. 71 C. = 471 C., *Ans.*

3. 2 mi. 15 C. = 175 C., which ÷ 3 rds. = 703 rds., and 703 rds. ÷ 18 l. = 17593 l., *Ans.*

5. 75 C. = 4950 ft., *Ans.*

7. 8 A. 2 sq. C. = 82 sq. C., which ÷ 7 P. = 1319 P., and 1319 P. ÷ 456 sq. l. = 824831 sq. l., *Ans.*

9. 80 A. = 800 sq. C. = 8000000 sq. l., *Ans.*

¶ 113. EXAMPLES FOR PRACTICE.

1. 9 T. = 450 cu. ft. = 777600 cu. in., *Ans.*

3. 37 C. ft. = 592 cu. ft., *Ans.*

7. 16 C. = 128 C. ft. = 2048 cu. ft., *Ans.*

9. 25 C. 5 C. ft. = 205 C. ft., which + 9 cu. ft. = 3289 cu. ft., and 3289 cu. ft. + 1575 cu. in. = 5684967 cu. in., *Ans.*

¶ 114. EXAMPLES FOR PRACTICE.

1. 12 P. = 24 hhd. = 1512 gal. = 6048 qts. = 12096 pts., *Ans.*

3. 9 P. 1 hhd. = 19 hhd., 19 hhd. 22 gal. = 1219 gal., 1219 gal. 3 qts. = 4879 qts. = 9758 pts. = 39032 gi., *Ans.*

5. 25 tier. = 1050 gal. = 4200 qts. = 8400 pts. = 33600 gi., *Ans.*

Beer Measure.

¶ 115. EXAMPLES FOR PRACTICE.

1. 47 bar. 18 gal. = 1710 gal. = 6840 qts. = 13680 pts., *Ans.*

3. 29 hhds. = 1566 gal. = 6264 qts. = 12528 pts., *Ans.*

Dry Measure.

¶ 116. EXAMPLES FOR PRACTICE.

1. 75 bu. = 300 pks. = 2400 qts. = 4800 pts., *Ans.*

3. 42 ch. = 1512 bu. = 6048 pks., *Ans.*

5. 273 qrs. 6 bu. 2190 bu., 2190 bu. + 3 pks. = 8763 pks., which + 7 qts. = 70111 qts., and 70111 qts + 1 pt. = 140223 pts., *Ans.*

Time.

¶ 117. EXAMPLES FOR PRACTICE.

1. From Jan. 1st, 1790, to Jan. 1st, 1804, was 14 yrs. = 5113 d. = 122712 h. = 7362720 m. = 441763200 s.; and from Jan. 1st to March 1st, 1804, including the two days named, was 61 d. = 1464 h. = 87840 m. = 5270400 s.; then, 441763200 s. + 5270400 s. = 447033600 s., *Ans.*

2. 447033600 s. = 7450560 m. = 124176 h. = 5174 d. = 739 wks. 1 d., *Ans.*

3. From July 4th, M., to Sept. 29th, 6 o'clock, P. M., is 87 d. 6 h. = 2094 h. = 125640 m., *Ans.*

4. 125640 m. = 2094 h. = 87 d. 6 h., which added to July 4th, M., gives the time to be Sept. 29th, 6 o'clock, P. M., *Ans.*

5. From 23 minutes past 4 o'clock, A. M., to 40 minutes past 7 o'clock, P. M., is 15 h. 17 m. = 917 m. = 55020 s., *Ans.*

6. 55020 s. = 917 m. = 15 h. 17 m., *Ans.*

7. From Apr. 19th, 1775, to Apr. 19th, 1782, was 7 yrs. = 2557 d. = 61363 h. = 3682080 mi.; and from Apr. 19th, 1782, to Jan. 20th, 1783, was 276 d. = 6624 h. = 397440 m.; then, 3682080 m. + 397440 m. = 4079520 m., *Ans.*

8. 4079520 m. = 67992 h. = 7 yrs. 276 d. 6 h., estimating 365 d. 6 h. as a year, or 7 yrs. 278 d., estimating 365 d. as a year, *Ans.*

¶ 118. EXAMPLES FOR PRACTICE.

1. 9 s. 13° = 283°; 283° 25' = 17005' = 1020300'', *Ans.*
3. 3 s. = 90° = 5400', *Ans.*

Reduction of Fractional Compound Numbers.

¶ 120. EXAMPLES FOR PRACTICE.

NOTE. In performing the examples in this ¶, it will generally be found more expeditious, to write each given fraction, and all the multipliers or divisors necessary to perform the required reduction, either as one compound fraction, or as several fractions to be multiplied together; the operations then may frequently be contracted by cancelation. See ¶¶ 60 and 80.

$$3. \frac{3}{760} \text{ lb. Troy} \times \frac{12}{1} \times \frac{20}{1} \times \frac{24}{1} = \frac{432}{19} \text{ gr., } \textit{Ans.}$$

$\begin{array}{r} 6 \\ 12 \\ 20 \\ 24 \end{array}$

$$4. \frac{432}{19} \text{ gr.} \times \frac{1}{24} \times \frac{1}{20} \times \frac{1}{12} = \frac{3}{760} \text{ lb., } \textit{Ans.}$$

$\begin{array}{r} 3 \\ 18 \\ 432 \end{array}$

$$5. \frac{1}{2740} \text{ hhd.} \times \frac{54}{1} \times \frac{4}{1} \times \frac{2}{1} = \frac{108}{685} \text{ pt., } \textit{Ans.}$$

$\begin{array}{r} 54 \\ 108 \end{array}$

$$6. \frac{108}{685} \text{ pt.} \times \frac{1}{2} \times \frac{1}{4} \times \frac{1}{54} = \frac{1}{2740} \text{ hhd., } \textit{Ans.}$$

$\begin{array}{r} 4 \\ 8 \end{array}$

$$7. \frac{8}{45} \text{ hhd.} \times \frac{54}{1} \times \frac{1}{36} = \frac{4}{15} \text{ bar., } \textit{Ans.}$$

$\begin{array}{r} 6 \\ 36 \end{array}$

$$8. \left(\frac{3}{4} = \right) \frac{4}{15} \text{ bar.} \times \frac{36}{1} \times \frac{1}{54} = \frac{8}{45} \text{ hhd., Ans.}$$

$$9. \frac{2}{22365} \text{ T.} \times \frac{2}{1} \times \frac{2}{1} \times \frac{63}{1} \times \frac{4}{1} \times \frac{2}{1} \times \frac{4}{1} = \frac{256}{355} \text{ gi., Ans.}$$

$$10. \left(\frac{16128}{22365} = \right) \frac{256}{355} \text{ gi.} \times \frac{1}{4} \times \frac{1}{2} \times \frac{1}{4} \times \frac{1}{63} \times \frac{1}{2} \times \frac{1}{2} = \frac{2}{22365} \text{ T., Ans.}$$

$$11. \frac{1}{10000000000} \text{ M.} \times \frac{640}{1} \times \frac{4}{1} \times \frac{40}{1} \times (272\frac{1}{4}) = \frac{1089}{4} \times \frac{144}{1} = \frac{156816}{390625} \text{ sq. in., Ans.}$$

NOTE. Cutting off the ciphers from 640 and 40 in the numerators, and two ciphers from the first denominator, in the above operation, divides the numerator and denominator of the product by 100.

$$12. \left(\frac{4014489600}{10000000000} = \right) \frac{1089}{390625} \text{ sq. in.} \times \frac{1}{144} \times \left(\frac{1}{272\frac{1}{4}} = \right) \frac{4}{1089} \times \frac{1}{40} \times \frac{1}{4} \times \frac{1}{640} = \frac{1}{10000000000} \text{ M., Ans.}$$

$$13. \frac{5}{2688} \text{ bu.} \times \frac{4}{1} \times \frac{8}{1} \times \frac{2}{1} = \frac{5}{42} \text{ pt., Ans.}$$

$$14. \frac{5}{42} \text{ pt.} \times \frac{1}{2} \times \frac{1}{8} \times \frac{1}{4} = \frac{5}{2688} \text{ bu., Ans.}$$

$$15. \frac{11}{1440} \text{ w.} \times \frac{7}{1} \times \frac{24}{1} = \frac{11}{60} \text{ h., Ans.}$$

$$16. \frac{11}{60} \text{ h.} \times \frac{1}{24} \times \frac{1}{7} = \frac{11}{10080} \text{ w., Ans.}$$

$$17. \frac{1}{\frac{3960}{\frac{33}{3}}} \text{ mi.} \times \frac{\frac{320}{1}}{1} \times (16\frac{1}{2}) = \frac{23}{2} = 11\frac{1}{2} \text{ ft., Ans.}$$

$$18. \frac{4}{3} \text{ ft.} \times (\frac{1}{16\frac{1}{2}}) = \frac{2}{33} \times \frac{1}{\frac{320}{40}} = \frac{1}{3960} \text{ mi., Ans.}$$

$$19. \frac{2}{9} \text{ of } \frac{1}{\frac{6}{3}} \text{ £.} \times \frac{20}{1} = \frac{20}{27} \text{ s., Ans.}$$

20. $\frac{20}{27} \text{ s.} \times \frac{1}{20} = \frac{1}{27} \text{ £.}$ Since $\frac{1}{27} \text{ £.}$ is $\frac{2}{9}$ of the required fraction, $\frac{1}{2}$ of $\frac{1}{27} = \frac{1}{54}$ is $\frac{1}{9}$, which $\times 9 = (\frac{1}{54} \times \frac{9}{1}) = \frac{1}{6}$, the required fraction, *Ans.*

$$21. \frac{1}{\frac{8}{4}} \text{ of } \frac{2}{11} \text{ of } \frac{3}{1} \text{ £.} \times \frac{\frac{20}{1}}{1} \times \frac{12}{1} = \frac{180}{11} \text{ d., Ans.}$$

22. 1st question. $\frac{\frac{15}{110}}{11} \text{ d.} \times \frac{1}{12} \times \frac{1}{20} = \frac{3}{44}$ of 1£., which $\div 3 = \frac{1}{44}$ of 3£. Since $\frac{1}{44}$ of 3£. is $\frac{1}{8}$ of the required fraction, 8 times $\frac{1}{44} = (\frac{1}{44} \times \frac{8}{1}) = \frac{2}{11}$ of 3£., is the required fraction, *Ans.*

2d. question. $\frac{\frac{15}{110}}{11} \text{ d.} \times \frac{1}{12} \times \frac{1}{20} = \frac{3}{44}$ of 1£., which $\div 3 = \frac{1}{44}$ of 3£. Since $\frac{1}{44}$ of 3£. is $\frac{1}{11}$ of the required fraction,

$\frac{1}{2}$ of $\frac{1}{44} = \frac{1}{88}$ is $\frac{1}{11}$, which $\times 11 = (\frac{1}{88} \times \frac{11}{1} =) \frac{1}{8}$ of 3£. is the required part, *Ans.*

3d. question. $\frac{150}{11}$ d. $\times \frac{1}{12} \times \frac{1}{20} = \frac{3}{44}$ of 1£. Since $\frac{3}{44}$ £.

is $\frac{1}{8}$ of $\frac{3}{11} = \frac{1}{44}$ of the required number of pounds, 44 times

$\frac{3}{44}$ £. = $(\frac{3}{44}$ £. $\times \frac{44}{1} =) 3$ £. is the required number of pounds, *Ans.*

¶ 121. EXAMPLES FOR PRACTICE.

5. $\frac{3}{5}$ lb. = $\frac{36}{5}$ oz. = $7\frac{1}{5}$ oz., $\frac{1}{5}$ oz. = $\frac{20}{5}$ pwt. = 4 pwt. *Ans.*, 7 oz. 4 pwt.

6. 7 oz. 4 pwt. = 144 pwt., the numerator; 1 lb. = 12 oz. = 240 pwt., the denominator; then, $\frac{144}{240}$ lb. = $\frac{3}{5}$ lb., *Ans.*

7. $\frac{5}{8}$ lb. = $\frac{20}{8}$ oz. = $8\frac{1}{2}$ oz., $\frac{1}{8}$ oz. = $\frac{120}{8}$ dr. = $14\frac{3}{4}$ dr. *Ans.*, 8 oz. $14\frac{3}{4}$ dr.

8. 8 oz. $14\frac{3}{4}$ dr. = $142\frac{3}{4}$ dr. = $\frac{1140}{4}$ dr.; 1 lb. = 16 oz. = 256 dr. = $\frac{2304}{4}$ dr.; then, $\frac{1140}{2304}$ lb. = $\frac{5}{8}$ lb., *Ans.*

9. $\frac{1}{4}$ mi. = $4\frac{1}{4}$ fur., $\frac{1}{4}$ fur. = $125\frac{1}{4}$ yds., $\frac{1}{4}$ yd. = $2\frac{1}{4}$ ft., $\frac{1}{4}$ ft. = $1\frac{1}{4}$ in., and $\frac{1}{4}$ in. = $2\frac{1}{4}$ bar. *Ans.*, 4 fur. 125 yds. 2 ft. 1 in. $2\frac{1}{4}$ bar.

10. 4 fur. 125 yds. = 1005 yds., 1005 yds. 2 ft. = 3017 ft., 3017 ft. 1 in. = 36205 in., 36205 in. $2\frac{1}{4}$ bar. = 108617 $\frac{1}{4}$ bar. = $\frac{769320}{4}$ bar.; 1 mi. = $\frac{1330560}{4}$ bar.; then, $\frac{769320}{1330560}$ mi. = $\frac{1}{4}$ mi., *Ans.*

11. $\frac{1}{5}$ w. = $5\frac{1}{5}$ d., $\frac{1}{5}$ d. = $14\frac{1}{5}$ h., and $\frac{1}{5}$ h. = 24 m. *Ans.*, 5 d. 14 h. 24 m.

12. 5 d. 14 h. 24 m. = 8064 m.; 1 w. = 10080 m.; then, $\frac{8064}{10080}$ w. = $\frac{1}{5}$ w., *Ans.*

13. $\frac{7}{16}$ A. = $1\frac{1}{2}$ R., and $\frac{1}{4}$ R. = 30 P. *Ans.*, 1 R. 30 P.

14. 1 R. 30 P. = 70 P.; 1 A. = 160 P.; then, $\frac{70}{160}$ A. = $\frac{7}{16}$ A., *Ans.*

15. $\frac{3}{10}$ yd. = $2\frac{7}{10}$ ft., $\frac{7}{10}$ ft. = $8\frac{1}{2}$ in., and $\frac{1}{10}$ in. = $1\frac{1}{2}$ bar. *Ans.*, 2 ft. 8 in. $1\frac{1}{2}$ bar.

16. 2 ft. 8 in. $1\frac{1}{2}$ bar. = $\frac{486}{10}$ bar.; 1 yd. = $\frac{360}{10}$ bar.; then, $\frac{486}{360}$ yds. = $\frac{9}{10}$ yd., *Ans.*

17. 3 R. $17\frac{1}{2}$ P. = $27\frac{1}{2}$ P.; 1 A. = $32\frac{0}{2}$ P.; then, $37\frac{5}{8}$ A. $\frac{5}{8}$ A., *Ans.*

18. 27 gal. 3 qts. 1 pt. = 223 pts.; 1 hhd. = 504 pts.; then, $22\frac{3}{4}$ hhd., *Ans.*

19. $\frac{5}{13}$ of $\frac{7}{13}$ cwt. = $\frac{35}{169}$ cwt. = $2\frac{2}{13}$ cwt., $\frac{9}{13}$ cwt. = $2\frac{10}{13}$ qrs., $\frac{10}{13}$ qrs. = $21\frac{1}{13}$ lbs., and $\frac{7}{13}$ lb. $8\frac{8}{13}$ oz. *Ans.*, 2 cwt. 2 qrs. 21 lbs. $8\frac{8}{13}$ oz.

The foregoing reversed. 2 cwt. 2 qrs. 21 lbs. $8\frac{8}{13}$ oz. is $\frac{5}{13}$ of how many cwt.? 2 cwt. 2 qrs. 21 lbs. $8\frac{8}{13}$ oz. = $627\frac{20}{13}$ oz.; 1 cwt. = $224\frac{20}{13}$ oz.; then, $627\frac{20}{13}$ cwt. $\div \frac{5}{13}$ = $(627\frac{20}{13} \times \frac{13}{5})$ $\frac{7}{13}$ cwt. = 7 cwt., that is, $\frac{5}{13}$ of 7 cwt., *Ans.*

20. 13 h. 42 m. $51\frac{1}{2}$ s. = $315\frac{600}{7}$ s.; 1 d. = 86400 s.; then, $3\frac{1}{3}\frac{5}{18}$ d. = $\frac{1}{3}$ d., *Ans.*

Reduction of Decimal Compound Numbers.

¶ 122. EXAMPLES FOR PRACTICE.

3. '213 T. = 4'26 cwt., '26 cwt. 1'04 qr., '04 qr. = 1'12 lb., '12 lb. = 1'92 oz., and '92 oz. = 14'72 dr. *Ans.*, 4 cwt. 1 qr. 1 lb. 1 oz. 14'72 drs.

4. 1 oz. 14'72 drs. = 1'92 oz., 1 lb. 1'92 oz. = 1'12 lb., 1 qr. 1'12 lb. = 1'04 qr., and 4 cwt. 1'04 qr. = 4'26 cwt. = '213 T., *Ans.*

5. 6 lb. = 7'2 z., '2 z. = 1'6 z., '6 z. = 1'8 d., and '8 d. = 16 grs. *Ans.*, 7 z. 1 z. 1 d. 16 grs.

6. 16 grs. = '8 d., 1'8 d. = '6 z., 1'6 z. = '2 z., and 7'2 z. = '6 lb., *Ans.*

7. '76754 M. = 491'2256 A., '2256 A. = 36'096 P., '096 P. = 26'136 sq. ft., and '136 sq. ft. = 19'584 sq. in. *Ans.*, 491 A. 36 P. 26 sq. ft. 19'584 sq. in.

8. 19'584 sq. in. = '136 sq. ft., 26'136 sq. ft. = '096 P., 36'096 P. = '2256 A., and 491'2256 A. = '76754 M., *Ans.*

9. '3958 bar. = 12'4677 gal., '4677 gal. = 1'8708 qt., '8708 qt. = 1'7416 pt., and '7416 pt. = 2'9664 gi. *Ans.*, 12 gal. 1 qt. 1 pt. 2'9664 gi.

10. 2'9664 gi. = '7416 pt., 1'7416 pt. = '8708 qt., 1'8708 qt. = '4677 gal., and 12'4677 gal. = '3958 bar. of wine, *Ans.*

11. '73 C. = 5'84 C. ft., 84 C. ft. = 13'44 cu. ft., and '44 cu. ft. = 760'32 cu. in. *Ans.*, 5 C. ft. 13 cu. ft. 760'32 cu. in.

12. 760'32 cu. in. = '44 cu. ft., 13'44 cu. ft. = '84 C. ft., and 5'84 C. ft. = '73 C., *Ans.*

13. '648 qr. = '5'184 bu., '184 bu. = '5'888 qts., and '888 qts. = 1'776 pts. *Ans.*, 5 bu. 5 qts. 1'776 pts.

14. 1'776 pts. = '888 qt., '5'888 qts. = '184 bu., and '5'184 bu. = '648 qr., *Ans.*

15. '125 lb. Troy = 1'5 oz., and '5 oz. = 10 pwt. *Ans.*, 1 oz. 10 pwt.

16. 10 pwt. = '5 oz., and 1'5 oz. = '125 lb. Troy, *Ans.*

17. '72 hhd. = 38'88 gal., and '88 gal. = 3'52 qts. *Ans.*, 38 gal. 3'52 qts.

18. 3'52 qts. = '88 gal., and 38'88 gal. = '72 hhd., *Ans.*

19. '375 yd. = 1'5 qrs., and '5 qr. = 2 na. *Ans.*, 1 qr. 2 na.

20. 2 na. = '5 qr., and 1'5 qrs. = '375 yd., *Ans.*

21. '713 d. = 17'112 h., '112 h. = 6'72 m., and '72 m. = 43'2 s. = 43½ s. *Ans.*, 17 h. 6 m. 43½ s.

22. 43½ s. = 43'2 s. = '72 m., 6'72 m. = '112 h., and 17'112 h. = '713 d., *Ans.*

23. 4 P. = '025 A., *Ans.* *Reversed*, '025 A. = 4 P.

24. '7 lb. Troy = 8'4 oz., and '4 oz. = 8 pwt. *Ans.*, 8 oz. 8 pwt.

25. 50'4 s. = '84 m., 15'84 m. = '264 h., and 18'264 h. = '761 d., *Ans.*

26. 2 ft. = '6 yd., 3'6 yds. = '6 rd., 2'6 rds. = '06 fur., 6'06 fur. = '7583 mi., and 11'7583 mi. = '169 deg., *Ans.*

¶ 123. Review of Reduction of Compound Numbers.

EXERCISES.

1. 46£. 4s. = 924s., which $\times 24\frac{1}{2}$ (the number of cents in 1s.) = \$223'608.

2. 3 lb. 5 oz. 16 pwt. 2 grs. = 20066 grs.; 5 pwt. 7 grs. = 127 grs.; then, 20066 grs. \div 127 grs. = 153 times = 153 rings, *Ans.*

3. 212 rds. = 41976 in.; and 18 ft. 6 in. = 222 in.; then, 41976 in. \div 222 in. = 189 $\frac{3}{4}$ times, *Ans.*

4. 10 lbs. = 2400 pwt.; 5 oz. 10 pwt. = 110 pwt.; then, 2400 pwt. \div 110 pwt. = 21 $\frac{8}{11}$ times = 21 $\frac{8}{11}$ spoons, *Ans.*

5. 6 sq. in. \times 4 (4 rows of 6 squares each) = 24 sq. in. covered by 1 shingle, and 144 sq. in. (= 1 sq. ft.) \div 24 sq. in. (= 1 shingle) = 6 shingles to cover 1 sq. ft.; 40 ft. \times 24 ft. (length \times breadth) = 960 sq. ft., (the area of the roof),
3*

which $\times 6$ (the number of shingles on 1 sq. ft.) = 5760 shingles, *Ans.*

6. 23 ft. (long) \times 4 ft. (wide) \times 6 ft. (high) = 624 cu. ft. = 39 C. ft. = 4 C. 7 C. ft., *Ans.*

7. $18 + 18 + 16 + 16 = 68$ ft. (length of all the walls,) which $\times 8 = 544$ sq. ft. (to be covered;) (11 yds. =) 33 ft. $\times 2$ ft. = 66 sq. ft. (in 1 piece of paper;) then, 544 sq. ft. \div 66 sq. ft. = $8\frac{8}{3}$ times = $8\frac{8}{3}$ rolls, *Ans.*

8. $6\frac{1}{2}$ ft. \times 2 ft. \times 5 ft. = 65 cu. ft. = $4\frac{1}{6}$ C. ft., *Ans.*

9. 3 w. 4 d. 16 h. = 616 h., and 7 mi. \times 616 = 4312 mi., *Ans.*

10. $\$2.75 \times 63$ (gal. = 1 hhd.) = $\$173.25$, cost of 1 hhd.; and $\$173.25 \times 12 = \2079 , cost of 12 hhds., *Ans.*

11. 10£. 8s. = 2496 l., and 5s. 4d. = 64d.; then, 2496d. \div 64d. = 39 times = 39 oz. = 3 lbs. 3 oz., *Ans.*

12. 2 lbs. 8 oz. 16 pwt. = 656 pwt.; 3d. \times 656 = 1968d. = 8£. 4s., *Ans.*

13. 9 qts. \times 365 = 3285 qts. = 15 hhds. 11 gal. 1 qt., *Ans.*

14. 14445 E. Fl. = 43335 qrs. = 8667 E. E., *Ans.*

15. $41\frac{1}{2} \times 3 = 133\frac{1}{2}$ shingles to lay 1 course; 20 ft. \times 3 = 60 courses on one side; $133\frac{1}{2} \times 60 = 8010$ shingles to cover one side; $8010 \times 2 = 16020$ shingles to cover both sides, *Ans.*

16. $54\frac{1}{2}$ mi. = 3453120 in., which \div 30 in. = 115104 times = 115104 steps, *Ans.*

17. 40 yrs. = 14610 d. Since he redeems $\frac{1}{2}$ hour (= 30 minutes) in 1 day, in 14610 days he would redeem $14610\frac{1}{2}$ hours = 438300 m. = 26298000 s., *Ans.*

18. 45 yrs. = 16136 days, which — 2348 (Sundays) = 14088 working days; 4s. \times 14088 = 56352 s., which \times $24\frac{1}{2}$ = $\$13637.184$, *Ans.*

19. 9 candles \times 24 = 216 candles, which \div 12 = 18 doz., *Ans.*

20. 4 lbs. 6 oz. = 70 oz. Since 16 oz. make 60 knots, 1 oz. will make $\frac{1}{16}$ of 60 knots = $\frac{3}{8}$ = $3\frac{3}{8}$ knots, and 70 oz. will make 70 times $3\frac{3}{8}$ knots = $262\frac{1}{2}$ knots = $26\frac{1}{4}$ skeins, *Ans.*

21. From the commencement of the Christian era till 12 o'clock at noon of Dec. 10th, 1847, would be 1846 years 343 days 12 hours, if the calendar had not been altered. But in Sept., 1752, 10 days were rejected from the calendar; hence, the exact time must be 1846 years 333 days 12 hours. In 1846 years are 457 leap years. Then, 1846 yrs. 333 d. =

674580 d., which, + 12 h. = 16189932 h., and 16189932 h. = 96368 $\frac{2}{3}$ w, *Ans.*

22. (Consult ¶ 120, Note.) $\frac{7}{1920}$ lb. Troy $\times \frac{12}{1} \times \frac{20}{1} =$
 $\frac{1}{8}$ pwts. *Ans.* 160
8

23. $\frac{3}{4}$ qr. $\times \frac{1}{4} \times \frac{1}{12} \times \frac{1}{20} = \frac{1}{1280}$ £., *Ans.*

24. 4 qrs. 1 $\frac{1}{2}$ na. = 17 $\frac{1}{2}$ na. = 3 $\frac{1}{2}$ na.; 1 E. E. = 20 na. = 4 $\frac{1}{2}$ na.; then, 3 $\frac{1}{2}$ E. E. = $\frac{7}{2}$ E. E., *Ans.*

25. 2 qrs. 2 $\frac{2}{3}$ na. = 10 $\frac{2}{3}$ na. = 3 $\frac{2}{3}$ na.; 1 yd. = 4 $\frac{2}{3}$ na.; then, 3 $\frac{2}{3}$ yd. = 2 yd., *Ans.*

26. 16 h. 36 m. 55 $\frac{5}{13}$ s. = 177 $\frac{600}{13}$ s.; 1 d. = 11232 $\frac{00}{13}$ s.; then, 777 $\frac{60}{13}$ d. = 9 $\frac{0}{13}$ d., *Ans.*

27. 6 fur. 23 r. 11 ft. = 4400 ft.; 1 mi. = 5280 ft.; then, 44 $\frac{0}{528}$ mi. = $\frac{5}{6}$ mi., *Ans.*

28. $\frac{3}{13}$ T. = 4 $\frac{8}{13}$ cwt., $\frac{8}{13}$ cwt. = 2 $\frac{6}{13}$ qrs., $\frac{6}{13}$ qr. = 12 $\frac{12}{13}$ lbs., $\frac{12}{13}$ lb. = 14 $\frac{12}{13}$ oz., and $\frac{12}{13}$ oz. = 12 $\frac{4}{13}$ drs. *Ans.*, 4 cwt. 2 qrs. 12 lbs. 14 oz. 12 $\frac{4}{13}$ drs.

29. 37 s. = 616 m., 55·616 m. = 9269 $\frac{1}{2}$ h. = 033622685 i d., *Ans.*

30. 9 grs. = 375 pwt., 13·375 pwt. = 66875 oz., and 10·66875 oz. = 8830625 lb., *Ans.*

31. 397 yd. = 1·583 qrs., and 538 qr. = 2·352 na. *Ans.*, 1 qr. 2·352 na.

Addition of Compound Numbers.

¶ 124. EXAMPLES FOR PRACTICE.

7. 11 s. + 13 s. + 5 s. = 34 s., 55 m. + 42 m. + 18 m. = 1 h. 55 m., 1 h. + 23 h. + 16 h. + 5 h. = 1 d. 21 h., 1 d. + 6 d. + 5 d. = 1 w. 5 d., 1 w. + 47 w. + 38 w. + 24 w. = 110 w. = 2 yrs. 5 w. 4 d. 12 h. 22 m. 24 s., and 2 yrs. + 57 yrs. + 84 yrs. + 32 yrs. = 175 yrs.; then, 175 yrs. 0 w. 5 d. 21 h. 55 m. 34 s. + 5 w. 4 d. 12 h. 22 m. 24 s. = 175 yrs. 6 w. 3 d. 10 h. 17 m. 58 s., *Ans.*

NOTE. The above conforms to the example as presented in the 1st edition of the Arithmetic. To simplify the operation, in later editions, the sum of the weeks will be found to be less than one year.

8. 10 drs. + 15 drs. + 9 drs. = 2 oz. 2 drs., 2 oz. + 5 oz. + 9 oz. + 11 oz. = 1 lb. 11 oz., 1 lb. + 16 lbs. + 11 lbs. + 25 lbs. = 1 qr. 25 lbs., 1 qr. + 1 qr. + 2 qrs. = 1 cwt., which +

11 cwt. + 18 cwt. = 1 T. 10 cwt., and 1 T. + 14 T. + 25 T. + 7 T. = 47 T. *Ans.*, 47 T. 10 cwt. 25 lbs. 11 oz. 2 drs.

11. (9576 lbs. =) 4 T. 1576 lbs. + 11 T. + (7 T. 18 cwt. 27 lbs. = 17723 lbs. =) 8 T. 1723 lbs. = 24 T. 1299 lbs., *Ans.*

26. $3^{\circ} 8' 45'' + 2^{\circ} 36' + 4^{\circ} 52'' + 1^{\circ} 48' 52'' + 1^{\circ} 19' + 59' 30'' = 13^{\circ} 52' 59''$ South. $1^{\circ} 51' + 2^{\circ} 1' 15'' + 1^{\circ} + 3^{\circ} 16' 22'' + 48' 29'' + 3^{\circ} 52' 11'' = 12^{\circ} 49' 17''$ East, *Ans.*

27. 116 sq. yds. 7 sq. ft. 96 sq. in. + 116 sq. yds. 7 sq. ft. 96 sq. in. + 178 sq. yds. 138 sq. in. + 178 sq. yds. 138 sq. in. + 439 sq. yds. 6 sq. ft. 78 sq. in. = 1029 sq. yds. 5 sq. ft. 114 sq. in., *Ans.*

29. 4 bar. 176 lbs. 8 oz. + 18 bar. (40½ lbs. =) 40 lbs. 8 oz. + 1 bar. 104 lbs. 7 oz. + (181½ bar. =) 181 bar. 147 lbs. = 206 bar. 76 lbs. 7 oz., *Ans.*

30. (2½ bu. =) 2 bu. 15 lbs. + 2 bu. 21 lbs. 7 oz. + (1½ bu. 18 lbs. =) 1 bu. 48 lbs. + 2 bu. 50 lbs. + 1 bu. (58½ lbs. =) 58 lbs. 12 oz. = 11 bu. 13 lbs. 3 oz., *Ans.*

31. 35 bar. 27 gal. 3 qts. + 19 bar. 5 gal. 1 qt. + 7 bar. 13 gal. 3 qts. = 62 bar. 14½ gal. 3 qts. = 62 bar. 15 gal. 1 qt., *Ans.*

32. 12 rds. 9 ft. 4 in. + 15 rds. 7 ft. 8 in. + 6 rds. 4 ft. 5 in. = 34 rds. 4½ ft. 5 in. = 34 rds. 4 ft. 11 in., *Ans.*

33. 59 deg. 46 mi. 6 fur. 39 rds. 15 ft. 10 in. + 216 deg. 39 mi. 7 fur. 39 rds. 4 ft. 7 in. + 78 deg. 53 mi. 7 fur. 38 rds. 9 ft. 8 in. = 355 deg. 1½ mi. 6 fur. 37 rds. 13½ ft. 1 in. = 355 deg. 2 mi. 4 fur. 11 rds. 2½ ft. 1 in. = 355 deg. 2 mi. 4 fur. 11 rds. 2 ft. 7 in., *Ans.*

34. 2 A. 75 P. 248 sq. ft. 72 sq. in. + 3 A. 120 P. 177 sq. ft. 85 sq. in. + 15 A. 17 P. 84 sq. ft. 80 sq. in. = 21 A. 53 P. 237½ sq. ft. 93 sq. in. = 21 A. 53 P. 238 sq. ft. 57 sq. in., *Ans.*

35. 25 gr. gr. 9 gr. 7 doz. 11 + 15 gr. gr. 7 gr. 8 doz. + 40 gr. gr. 4 doz. = 81 gr. gr. 5 gr. 7 doz. 11 screws, *Ans.*

ADDITION OF FRACTIONAL COMPOUND NUMBERS.

¶ 125. 2. 7£. = 17s. 6d.; ¾s. = 9d.; and 17s. 6d. + 9d. = 18s. 3d., *Ans.*

3. ¾ gal. = 3 qts. ¾ pt., which + ¾ pt. = 3 qts. 1½ pts., *Ans.*

4. ½ lb. Troy = 6 oz.; ⅞ oz. = 11 pwt. 16 grs.; and 6 oz. + 11 pwt. 16 grs. = 6 oz. 11 pwt. 16 grs., *Ans.*

5. $\frac{3}{5}$ mi. = 192 rds., $\frac{3}{11}$ rd. = 4 ft. 6 in.; and 192 rds. + 47 rds. 4 ft. 6 in. = 239 rds. 4 ft. 6 in., *Ans.*

6. $\frac{3}{8}$ of $(20\frac{1}{2})$ = $15\frac{1}{4}$ yds. = $12\frac{3}{4}$ yds. = $7\frac{1}{4}$ yds. = 7 yds. 2 qrs. 3 na.; $\frac{5}{8}$ of $(9\frac{1}{4})$ = $5\frac{7}{8}$ yds. = $4\frac{7}{8}$ yds. = $7\frac{1}{4}$ yds. = 7 yds. 2 qrs. 3 na.; and 7 yds. 2 qrs. 3 na. + 7 yds. 2 qrs. 3 na. = 15 yds. 1 qr. 2 na., *Ans.*

Subtraction of Compound Numbers.

¶ 126. EXAMPLES FOR PRACTICE.

7. 136£. 7s. 6d. 2qrs. — 50£. 10s. 4d. 3qrs. = 85£. 17s. 1d. 3 qrs., *Ans.*

8. 1256£. 10s. — 87£. 10s. 6d. = 1168£. 19s. 6d., *Ans.*

9. 118 gal. — 97 gal. 3 qts. 1 pt. = 20 gal. 0 qt. 1 pt., *Ans.*

10. 3 lb. 4 oz. — 5 oz. 7 pwt. 13 grs. = 2 lb. 10 oz. 12 pwt. 11 grs., *Ans.*

11. 256 A. 1 R. 10 P. — 87 A. 6 P. 10 sq. yds. = 169 A. 1 R. 3 P. 20 sq. yds. 2 sq. ft. 36 sq. in., *Ans.*

12. 15 lb. 2 oz. 5 pwt. — 9 oz. 8 pwt. 10 grs. = 14 lb. 4 oz. 16 pwt. 14 grs., *Ans.*

13. 10 yds. 3 qrs. 2 na. + 18 yds. 3 qrs. 3 na. = 29 yds. 3 qrs. 1 na.; then, 36 yds. 2 qrs. — 29 yds. 3 qrs. 1 na. = 6 yds. 2 qrs. 3 na., *Ans.*

14. 13 A. 3 R. + 14 A. 3 R. = 28 A. 2 R.; 26 A. 2 R. 27 P. + 45 A. 2 R. 33 P. = 72 A. 1 R. 20 P.; then, 72 A. 1 R. 20 P. — 28 A. 2 R. = 43 A. 3 R. 20 P., *Ans.*

17. 19 P. 55 sq. ft. 126 sq. in. — 7 P. 92 sq. ft. 11 sq. in. = 11 P. 235 sq. ft. 115 sq. in. = 11 P. 236 sq. ft. 7 sq. in., *Ans.*

18. 64 A. 2 R. 11 P. 29 sq. ft. — 26 A. 7 R. 34 P. 132 sq. ft. = 36 A. 2 R. 16 P. 169 sq. ft. 36 sq. in., *Ans.*

NOTE. In subtracting 7 R. from 1 R., we must borrow 2 A. from 64 A.

19. (9 rds. 5 yds. 2 ft. 11 in. =) 10 rds. 0 yd. 1 ft. 5 in. — 10 rds. 0 yd. 1 ft. 2 in. = 3 in., *Ans.*

20. (8 C. 76 cu. ft. =) 8 C. 4 C. ft. 12 cu. ft. + 5 C. 7 C. ft. = 14 C. 3 C. ft. 12 cu. ft.; then, 21 C. — 14 C. 3 C. ft. 12 cu. ft. = 6 C. 4 C. ft. 4 cu. ft. = 6 C. 68 cu. ft., *Ans.*

¶ 127. Distance of Time from one date to another.

4. 1847th yr. 9th mo. 1st. d. — 1842d yr. 4th mo. 14th d. = 5 yrs. 4 m. 17 d., the whole time. 1843d yr. 10th mo.

30th d. — 1842d yr. 4th mo. 14th d. = 1 yr. 6 mo. 16 d., time without interest. 1847th yr. 9th mo. 1st d. — 1843d yr. 10th mo. 30th d. = 3 yrs. 10 mo. 1 d., time with interest.

Subtraction of Fractional Compound Numbers.

¶ 128. 2. $\frac{3}{4}$ oz. Troy = 12 pwt.; $\frac{1}{4}$ pwt. = 21 grs.; and 12 pwt. — 21 grs. = 11 pwt. 3 grs., *Ans.*

3. $\frac{3}{4}$ bu. = 3 pks. 5 qts.; $\frac{1}{4}$ pk. = 7 qts. 1 pt.; and 3 pks. 5 qts. — 7 qts. 1 pt. = 2 pks. 5 qts. 1 pt., *Ans.*

4. $\frac{1}{4}$ mi. = 13 rds. 5 ft. 6 in.; $\frac{1}{4}$ fur. = 6 rds. 11 ft.; and 13 rds. 5 ft. 6 in. — 6 rds. 11 ft. = 6 rds. 11 ft., *Ans.*

5. $\frac{4}{5}$ of $(19\frac{1}{4}) = \frac{77}{4}$ gal. = $\frac{77}{5}$ gal. = $15\frac{2}{5}$ gal. = 15 gal. 1 qt.

1 pt. $\frac{4}{5}$ gi.; $\frac{1}{2}$ of $(3\frac{1}{2}) = \frac{13}{8}$ qts. = $\frac{13}{8}$ qts. = $1\frac{5}{8}$ qts. = 1 qt. 1 pt. $3\frac{1}{2}$ gi.; then, 15 gal. 1 qt. 1 pt. $\frac{4}{5}$ gi. — 1 qt. 1 pt. $3\frac{1}{2}$ gi. = 14 gal. 3 qts. 1 pt. $1\frac{3}{8}$ gi., *Ans.*

Multiplication and Division of Compound Numbers.

¶ 129. EXAMPLES FOR PRACTICE.

7. 6d. $\times 5 = 30$ d. = 2s. 6d., and 10s. $\times 5 = 50$ s., which + 2s. = 52s. = 2£. 12s. *Ans.*, 2£. 12s. 6d.

8. (2£. 12s. =) 52s. $\div 5 = 10$ s. and 2s. remainder; (2s. 6d. =) 30d. $\div 5 = 6$ d. *Ans.* 10s. 6d.

¶ 130. 3. $4 \times 6 = 24$; then, 2£. 12s. 4d. $\times 4 = 10$ £. 9s. 4d., which $\times 6 = 62$ £. 16s., *Ans.*

4. 62£. 16s. $\div 6 = 10$ £. 9s. 4d., which $\div 4 = 2$ £. 12s. 4d., *Ans.*

5. $8 \times 7 \times 2 = 112$; then, 2 bu. 1 pk. $\times 8 = 18$ bu., 18 bu. $\times 7 = 126$ bu., which $\times 2 = 252$ bu., *Ans.*

6. 252 bu. $\div 2 = 126$ bu., 126 bu. $\div 7 = 18$ bu., which $\div 8 = 2$ bu. 1 pk., *Ans.*; or, 252 bu. $\div 8 = 31$ bu. 2 pks., which $\div 7 = 4$ bu. 2 pks., and 4 bu. 2 pks. $\div 2 = 2$ bu. 1 pk., *Ans.*, as before.

NOTE. We see from the last operation, that the quotient is not altered by changing the order of the factors of the divisor.

7. $7 \times 12 = 84$; 112 gal. 2 qts. 1 pt. 3 gi. $\times 7 = 789$ gal. 1 gi., which $\times 12 = 9468$ gal. 1 qt. 1 pt., *Ans.*

9. $3 \times 9 \times 5 = 135$; 2 bu. 3 pks. $\times 3 = 8$ bu. 1 pk., 8 bu. 1 pk. $\times 9 = 74$ bu. 1 pk., which $5 = 371$ bu. 1 pk., *Ans.*

11. $5 \times 5 = 25$; 32 yds. 2 qrs. 1 na. $\times 5 = 162$ yds. 3 qrs. 1 na., which $\times 5 = 814$ yds. 1 na., *Ans.*

¶ 131. EXAMPLES FOR PRACTICE.

3. 75 A. 2 R. 25 P. $\times 10 = 756$ A. 2 R. 10 P. in 10 lots, 756 A. 2 R. 10 P. $\times 10 = 7565$ A. 2 R. 20 P. in 100 lots, which $\times 2 = 15131$ A. 1 R. in 200 lots; 756 A. 2 R. 10 P. $\times 4 = 3026$ A. 1 R. in 40 lots; then, 15131 A. 1 R. $+ 3026$ A. 1 R. $+ 75$ A. 2 R. 25 P. $= 18233$ A. 25 P., in 241 lots, *Ans.*

4. 18233 A. 25 P. $\div 241 = 75$ A. 2 R. 25 P., *Ans.*

5. 78 lbs. 9 oz. $\times 10 = 785$ lbs. 10 oz. in 10 chests, which $\times 2 = 1571$ lbs. 4 oz. in 20 chests; 78 lbs. 9 oz. $\times 3 = 235$ lbs. 11 oz. in 3 chests; then, 1571 lbs. 4 oz. $+ 235$ lbs. 11 oz. $= 1806$ lbs. 15 oz. in 23 chests, *Ans.*

7. 9£. 11s. 6d. $\times 10 = 95$ £. 15s., cost of 10 bales; 95£. 15s. $\times 10 = 957$ £. 10s., cost of 100 bales, which $\times 3 = 2872$ £. 10s., cost of 300 bales; 95£. 15s. $\times 7 = 670$ £. 5s., cost of 70 bales; and 9£. 11s. 6d. $\times 5 = 47$ £. 17s. 6d., cost of 5 bales; then, 2872 £. 10s. $+ 670$ £. 5s. $+ 47$ £. 17s. 6d. $= 3590$ £. 12s. 6d., cost of 375 bales, *Ans.*

NOTE. 375 in the above operation $= 5 \times 5 \times 5 \times 3$.

9. 22 bu. 3 pks. 5 qts. $\times 10 = 229$ bu. 2 qts. on 10 acres, which $\times 10 = 2290$ bu. 2 pks. 4 qts. on 100 acres; 229 bu. 2 qts. $\times 2 = 458$ bu. 4 qts. on 20 acres; and 22 bu. 3 pks. 5 qts. $\times 5 = 114$ bu. 2 pks. 1 qt. on 5 acres; then, 2290 bu. 2 pks. 4 qts. $+ 458$ bu. 4 qts. $+ 114$ bu. 2 pks. 1 qt. $= 2863$ bu. 1 pk. 1 qt. on 125 acres, *Ans.*

NOTE. In the above operation $125 = 5 \times 5 \times 5$.

¶ 132. Difference in Longitude and Time between different places.

3. 1° of longitude $= 4$ m. of time, and $11^\circ = 4$ m. $\times 11 = 44$ m. of time; and 12 h. $- 44$ m. $= 11$ h. 16 m., that is, 16 minutes past 11 o'clock, *Ans.*

4. 4 m. of time $= 1^\circ$ of longitude, and 44 m. $= \frac{4}{15}^\circ = 11^\circ$, the difference in longitude, *Ans.*

5. A meteor is transient in its appearance, and in all places where seen, must be seen at the same instant of time;

the question, therefore, is the same as if it had been, "At 47 minutes past 11 o'clock, P. M., of Dec. 31st, 1847, at Washington, what is the time at Boston? at the Sandwich Islands?" The difference between the Washington and Boston time (26 m. 40 s.) must be added to the Washington time to find the Boston time, = 13 m. 40 s., A. M., of Jan. 1st, 1848; and the difference between the Washington and the Sandwich Island time (5 h. 9 m. 8 s.) must be subtracted from the Washington time, to give the Sandwich Island time, = 37 m. 52 s. past 6 o'clock, P. M., of Dec. 31st., 1847, *Ans.*

¶ 133. Review of Compound Numbers.

EXERCISES.

1. 3 oz. 5 pwt. $\times 3 \times 6 = 4$ lb. 10 oz. 10 pwt.; 15 pwt. 14 gr. $\times 4 \times 6 = 1$ lb. 6 oz. 14 pwt.; 9 oz. 7 pwt. $\times 3 = 2$ lb. 4 oz. 1 pwt.; 1 lb. 9 oz. 15 pwt. $\times 2 = 3$ lb. 7 oz. 10 pwt.; 11 oz. 18 pwt. $\times 6 = 5$ lb. 11 oz. 8 pwt.; the several products added = 18 lb. 4 oz. 3 pwt., *Ans.*

2. 27 yds. 3 qrs. $\times 5 \times 7 = 971$ yds. 1 qr., *Ans.*

3. 45 gal. 3 qts. 1 pt. $\times 9 = 412$ gal. 3 qts. 1 pt. *Ans.*

5. 889 bu. 2 pks. 6 qts. $\div 365 = 2$ bu. 1 pk. 6 qts., the quantity which 8 horses will consume in 1 day; and 2 bu. 1 pk. 6 qts. $\div 8 = 1$ pk. 1 qt. 1 pt. 2 gi., the quantity which 1 horse will consume in 1 day, *Ans.*

6. 61£. 5s. + 195£. 13s. 11d. = 256£. 18s. 11d., and 735£. 11s. 6d. - 256£. 18s. 11d. = 478£. 12s. 7d., *Ans.*

7. 4s. 6d. $\times 10 = 2$ £. 5s.; 5s. $\times 12 = 3$ £.; 5s. 6d. $\times 4 = 2$ £. 2s.; 10s. $\times 4 = 2$ £.; 11s. $\times 4 = 2$ £. 4s.; 12s. $\times 6 = 3$ £. 12s.; 14s. $\times 6 = 4$ £. 4s.; and the sum of the several products + 1£. 4s. = 19£. 11s., *Ans.*

8. 16 bar. 23 gal. 3 qts. $\div 5 = 3$ bar. 10 gal. $4\frac{1}{2}$ qts. = 3 bar. 11 gal. $\frac{1}{2}$ qt., *Ans.*

9. $3 \times 7 = 21$. 3 P. 112 sq. ft. 81 sq. in. $\times 3 \times 7 = 1$ R. 31 P. 185 sq. ft. 117 sq. in.; then, (1 A. =) 4 R. - 1 R. 31 P. 185 sq. ft. 117 sq. in. = 2 R. 8 P. 86 $\frac{1}{4}$ sq. ft. 27 sq. in. = 2 R. 8 P. 86 sq. ft. 63 sq. in., *Ans.*

10. 3 rds. 9 ft. 7 in. $\times 3 \times 5 = 53$ rds. 11 ft. 9 in., *Ans.*

11. $3^{\circ} 18' 45'' \times 10 \times 3 = 99^{\circ} 22' 30''$, *Ans.*

12. 30 d. + 31 d. + 30 d. = 91 d. = 13 w.; then, 1 gr. 7 doz. $\times 13 = 20$ gr. 7 doz., *Ans.*

13. $\$1000000 \div \$100 = 10000$ times = 10000 m. = 166 $\frac{2}{3}$ h. = 16 $\frac{2}{3}$ d. of 10 hours each, *Ans.*

14. $\$1000000000 \div \$100 = 10000000$ times = 10000000

m. = 166666 $\frac{2}{3}$ h. = 16666 $\frac{2}{3}$ d. of 10 hours each = 45 yrs. 241 $\frac{2}{3}$ d., *Ans.*

15. $\$1000000000000000 \div (\$100 \times 1000) = \$100000 = 100000000000 \text{ times} = 10000000000 \text{ m.} = 166666666\frac{2}{3} \text{ h.} = 16666666\frac{2}{3} \text{ d. of 10 hours each} = 45662 \text{ yrs. } 36\frac{2}{3}, \text{ Ans.}$

ANALYSIS.

¶ 134. EXAMPLES FOR PRACTICE.

1. 1 hhd. 15 gal. 3 qts. = '3125 T.; then, $\$302\cdot40 \times '3125 = \$94\cdot50$, *Ans.*
2. $\$94\cdot50 \div '3125 = \$302\cdot40$, *Ans.*
3. $\$94\cdot50 \div \$302\cdot40 = '3125 \text{ T.} = 1 \text{ hhd. } 15 \text{ gal. } 3 \text{ qts.}$, *Ans.*
4. 3 $\frac{1}{2}$ qts. = '8125 gal.; then, $\$2\cdot215 \times '8125 = \$1\cdot80$, *Ans.*
5. $\$1\cdot80 \div '8125 = \$2\cdot215$, *Ans.*
6. $\$1\cdot80 \div 2\cdot215 = '8125 \text{ gal.} = 3\frac{1}{2} \text{ qts.}$, *Ans.*
7. $\$96\cdot72 \times \frac{1}{2} = \$60\cdot45$, *Ans.*
8. $\$60\cdot45 \div \frac{1}{2} = \$96\cdot72$, *Ans.*
9. $\$60\cdot45 \div \$96\cdot72 = \frac{5}{8} = \frac{5}{8} \text{ ton}$, *Ans.*
10. $\$2\cdot5 \times '8 = \2 , *Ans.*
11. $\$2 \div '8 = \$2\cdot5$, *Ans.*
12. $\$2 \div \$2\cdot5 = '8 \text{ yd.}$, *Ans.*
13. 14 cwt. = '7 T.; then, $(27\text{£. } 10\text{s.}) \times '7 = 19\cdot25\text{£.} = 19\text{£. } 5\text{s.}$, *Ans.*
14. $(19\text{£. } 5\text{s.}) \div 19\cdot25\text{£.} \times '7 = 27\cdot5\text{£.} = 27\text{£. } 10\text{s.}$, *Ans.*
15. $(19\text{£. } 5\text{s.}) \div 19\cdot25\text{£.} \times (27\text{£. } 10\text{s.}) \times '7 \text{ T.} = 14 \text{ cwt.}$, *Ans.*
16. 1 pk. 4 qts. = '375 bu.; then, $\$1\cdot92 \times '375 = \$\cdot72$, *Ans.*
17. $\$1\cdot92 \div '375 = 375 \text{ bu.} = 1 \text{ pk. } 4 \text{ qts.}$, *Ans.*
18. 16 yds. 2 qrs. 3 na. = 16'6875 yds.; then, $\$6 \times 16\cdot6875 = \$100\cdot125$, *Ans.*
19. $\$100\cdot125 \div \$6 = 16\cdot6875 \text{ yds.} = 16 \text{ yds. } 2 \text{ qrs. } 3 \text{ na.}$, *Ans.*
20. 1850 lbs. = '925 T.; then, $\$13 \times '925 = \$12\cdot025$, *Ans.*
21. $\$12\cdot025 \div \$13 = '925 \text{ T.} = 1850 \text{ lbs.}$, *Ans.*
22. 31 lbs. 2 oz. 1 pwt. 6 grs. = 179550 grs.; 11 pwt. 6 grs. = 270 grs.; and $179550 \text{ grs.} \div 270 \text{ grs.} = 665 \text{ times} = 665 \text{ eagles}$, *Ans.*
23. $\$200 \div \$1\cdot75 = 114\frac{2}{3} \text{ times} = 114\frac{2}{3} \text{ bu.} = 11 \text{ qrs. } 2 \text{ bu. } 1 \text{ pk. } 1\cdot1428\frac{1}{3} \text{ qts.}$, *Ans.*

29. 3 qrs. 2 na. = '875 yd.; then, $\$6 \times '875 = \5.25 ,
Ans.

30. 6500 lbs. = 3.25 T.; then, $\$22.10 \div 3.25 = \6.80 ,
Ans.

31. 9 oz. 4 pwt. 16 grs. = $9\frac{7}{8}$ oz.; then, $\$11.08 \div 9\frac{7}{8} =$
 $(\frac{1108}{100} \times \frac{30}{277} =) \frac{3324}{2770} = \1.20 , *Ans.*

32. $\$1.25 \div \$20 = .0625$ oz. = 1 pwt. 6 grs., *Ans.*

35. $28\frac{1}{2}$ d. $\times 16 = 453\frac{1}{2}$ d., the time it would take 1 man,
 which $\div 12 = 37\frac{7}{8}$ d., the time it will take 12 men, *Ans.*

36. 20 yds. $\times \frac{3}{4}$ yd. = 15 sq. yds., the contents of the cas-
 simere, and 15 sq. yds. $\div (1\frac{1}{4} =) \frac{1}{4} = 12$ yds. of alpaca,
Ans.

37. If we knew how much 1 horse consumed in 1 week,
 it would be easy to find how much 12 horses would consume
 in 8 weeks.

$2\frac{1}{2} = \frac{5}{2}$ tons. If 7 horses consume $\frac{5}{2}$ tons in 6 weeks, 1
 horse will consume $\frac{1}{7}$ of $\frac{5}{2} = \frac{5}{14}$ of a ton in 6 weeks; and if
 a horse consume $\frac{5}{14}$ of a ton in 6 weeks, he will consume $\frac{1}{6}$
 of $\frac{5}{14} = \frac{5}{84}$ of a ton in 1 week. 12 horses will consume 12
 times $\frac{5}{84} = \frac{5}{7}$ in 1 week, and in 8 weeks they will consume
 8 times $\frac{5}{7} = \frac{40}{7} = 6\frac{2}{7}$ tons, *Ans.*

38. If 5 persons drink $(7\frac{1}{2} =) \frac{15}{2}$ gal. in 1 week, 1 person
 would drink $\frac{1}{5}$ of $\frac{15}{2} = \frac{3}{2}$ gal. in 1 week; 8 persons would
 drink 8 times $\frac{3}{2} = \frac{12}{2}$ gal. in 1 week, and in $(22\frac{1}{2} =) \frac{45}{2}$

weeks they would drink $\frac{156}{25} \times \frac{9}{2} = \frac{1404}{5} = 280\frac{4}{5}$ gal., *Ans.*

39. \$11 for 7 yds. is $\frac{1}{7}$ of $\$11 = \$1\frac{1}{7}$ for 1 yard sold, and
 \$7 for 5 yds. is $\frac{1}{5}$ of $\$7 = \$1\frac{2}{5}$ for 1 yd. bought; now, $(\$1\frac{1}{7} =)$
 $\$1\frac{1}{7} - (\$1\frac{2}{5} =) \$\frac{4}{35} = \$\frac{8}{70}$ = gain on 1 yard; then,
 $\$200 \div \$\frac{8}{70} = 1000 = 1166\frac{2}{3}$ yds.; and $1166\frac{2}{3} (\frac{2}{3} =) \frac{1}{3} \div$
 $129\frac{1}{7} = 9$ bales, *Ans.*

40. If $(\frac{1}{3} =) \frac{2}{3} - \frac{1}{3} = \frac{1}{3}$ lb. cost $(13\frac{1}{2} =) \frac{27}{2}$ s.d., then 1 lb.
 $(= \frac{2}{3})$ will cost 6 times as much = $\frac{27}{2} \times 6 = 81$ s.d.; (14 lbs. =) $\frac{14}{3}$
 lb. — $(\frac{1}{3}$ of $\frac{14}{3} =) \frac{14}{9}$ lb. = $\frac{28}{9}$ s.d., and $\frac{27}{2}$ s.d. (cost of 1 lb.) $\times \frac{28}{9}$
 $= 26\frac{2}{3}$ s.d. = 4£. 9s. 9 $\frac{2}{3}$ d., *Ans.*

41. 26 qrs. 2 bu. = 210 bu.; 5.25 A. $\div 210 = .025$ A., (to
 produce 1 bushel,) which $\times 380$ (the number of bushels in
 47 qrs. 4 bu.) = 9.5 A. = 9 A. 2 R., *Ans.*

42. If 9 students spend $(10\frac{1}{2} =) \frac{21}{2}$ £. in 18 days, 1 stu-
 dent will spend $\frac{1}{9}$ of $\frac{21}{2}$ £. = $\frac{7}{4}$ £. in 18 days, and $\frac{1}{18}$ of $\frac{7}{4}$ £.

$= \frac{21}{11} \text{ £. in 1 day; 20 students will spend 20 times } \frac{21}{11} \text{ £.}$
 $= \frac{42}{11} \text{ £. in 1 day, and in 30 days 30 times } \frac{42}{11} \text{ £.} =$
 $\frac{84}{11} \text{ £.} = 39 \text{ £. 18s. 4} \frac{2}{3} \text{ d., Ans.}$

43. $\frac{1}{2} \text{ yd. will cost } \frac{1}{2} \text{ of } \$7 = \$3 \frac{1}{2}$, which $\times 5 = \$17 \frac{1}{2}$,
 cost of 1 yd.; $\$3 \frac{1}{2} \times (40 \frac{1}{2} = 21) = \$73 \frac{1}{2} = \$59 \cdot 062 \frac{1}{2}$, *Ans.*

44. If $(\frac{1}{18} =) \frac{1}{2}$ of the ship cost \$251, then $\frac{1}{2}$ part of it
 will cost $\frac{1}{18}$ of $\$251 = \$13 \frac{1}{2}$, and $\frac{1}{2}$ of it will cost 3 times
 as much $= \$40 \frac{1}{2} = \$53 \cdot 785 \frac{1}{2}$, *Ans.*

45. 1 cwt. = 112 lb.; then, 1 lb. will cost $\frac{1}{112}$ of $(3 \frac{1}{2} \text{ £.}) =$
 $\frac{7}{224} \text{ £.} = \frac{1}{32} \text{ £.};$ and $(9 \frac{3}{4} =) \frac{19}{2} \text{ lb. will cost } \frac{19}{2}$ as much, that
 is, $\frac{19}{2}$ of $\frac{1}{32} \text{ £.} = \frac{19}{64} \text{ £.} = 6 \text{ s. } 3 \frac{1}{2} \text{ d., Ans.}$

46. $\frac{2}{3}$ of $\frac{1}{2} = \frac{1}{3}$ = the part of the vessel sold; then, if $\frac{1}{3}$
 of the vessel cost \$957, $\frac{1}{3}$ of it will cost $\frac{1}{3}$ of $\$957 = \319 ,
 and $\frac{1}{3}$ will cost 15 times as much $= \$4785 = \$1794 \cdot 375$,
Ans.

47. If $(\frac{1}{2} \text{ yd.} = \frac{2}{3} \text{ qr.} = \frac{1}{3} \text{ E. E.} = \frac{1}{2} =) \frac{1}{3} \text{ E. E. cost}$
 $\frac{1}{3} \text{ £.},$ then $\frac{1}{3} \text{ E. E. will cost } \frac{1}{3} \text{ of } \frac{1}{3} \text{ £.} = \frac{1}{9} \text{ £.},$ and $(\frac{1}{3} =)$
 $\frac{1}{3} \text{ E. E. will cost 18 times as much} = \frac{18}{9} \text{ £.} = 2 \text{ £.}$
 $\frac{2}{3} \text{ qr., Ans.}$

PRACTICE.

¶ 135. EXAMPLES FOR PRACTICE.

8. $12 \frac{1}{2} \text{ cents} = \frac{1}{8} \text{ of a dollar, and } \$264 \div 8 = \$33$, *Ans.*

10. $\$1 \cdot 12 \frac{1}{2} = 1 \text{ dollar and } \frac{1}{8} \text{ of another dollar; } \frac{1}{8} \text{ time}$
 $\$8460 \text{ and } \frac{1}{8} \text{ of another time} = \$9517 \cdot 50$, *Ans.* At $\$4 \cdot 06 \frac{1}{2}$
 $= 4 \text{ dollars and } \frac{1}{16} \text{ part of another dollar; } \$8460 \times 4 =$
 $\$33840$; and $\$8460 \div 16 = \$528 \cdot 75$; then, $\$33840 +$
 $\$528 \cdot 75 = \$34368 \cdot 75$, *Ans.*

¶ 136. 3. $3460 \times \$4 = \13840 , (removing the separ-
 atrix two places,) *Ans.*

4. $24650 \times \$5 = \123250 , (... three places,) *Ans.*

5. $4750 \times \$12 \cdot 25 = \$58187 \cdot 50$, (... three places,) *Ans.*

6. $38600 \times \$4 \cdot 75 = \183300 , (... three places,) *Ans.*

7. $46590 \times \$10 \cdot 625 = \$495018 \cdot 75$, (... three places,) *Ans.*

8. $75 \times \$4 = \300 , (... two places,) *Ans.*

9. $4000 \times \$3 = \12000 , (... three places,) *Ans.*

ORDER. In ¶ 136 the sums expressed in Federal Money must precede the
 sign X, and the other numbers follow it.

¶ 137. 2. $\$7 \cdot 50 \div 2 = \$3 \cdot 75 = \text{price of 1000 lbs.,}$

which $\times 15742 = 959\cdot032+$, (removing the separatrix three places,) *Ans.*

¶ 138. EXAMPLES FOR PRACTICE.

2. $1873\text{£.} + 3 = 624\text{£. } 6\text{s. } 8\text{d.}, \text{ Ans.}$

5. $14\text{s.} = 10\text{s.} (= \frac{1}{2}\text{£.}) + 4\text{s.} (= \frac{1}{4}\text{£.};) 866\text{£.} \div 2 = 433\text{£.}, \text{ and } 866\text{£.} \div 5 = 173\text{£. } 4\text{s.}; \text{ then, } 433\text{£.} + 173\text{£. } 4\text{s.} = 606\text{£. } 4\text{s.}, \text{ Ans.}$

6. $7 \text{ T. } 8 \text{ cwt.} = 148 \text{ cwt.}; 16\text{s. } 8\text{d.} = 10\text{s.} (= \frac{1}{2}\text{£.}) + 6\text{s. } 8\text{d.} (= \frac{1}{4}\text{£.};) 148\text{£.} \div 2 = 74\text{£.}, \text{ and } 148\text{£.} \div 3 = 49\text{£. } 6\text{s. } 8\text{d.}; \text{ then, } 74\text{£.} + 49\text{£. } 6\text{s. } 8\text{d.} = 123\text{£. } 6\text{s. } 8\text{d.}, \text{ Ans.}$

¶ 139. EXAMPLES FOR PRACTICE.

1. $4\text{d.} = \frac{1}{4}\text{s.} \text{ and } 348216\text{s.} \div 3 = 116072\text{s.} = 5803\text{£. } 12\text{s.}, \text{ Ans.}$

2. $9\text{d.} = 6\text{d.} + 3\text{d.}; 2490\text{s.} \div 2 = 1245\text{s.} = 62\text{£. } 5\text{s.}, \text{ and } 2490\text{s.} \div 4 = 622\text{s. } 6\text{d.} = 31\text{£. } 2\text{s. } 6\text{d.}; \text{ then, } 62\text{£. } 5\text{s.} + 31\text{£. } 2\text{s. } 6\text{d.} = 93\text{£. } 7\text{s. } 6\text{d.}, \text{ Ans.}$

3. $4\frac{1}{2}\text{d.} = 3\text{d.} + 1\frac{1}{2}\text{d.}; 4000\text{s.} \div 4 = 1000\text{s.} = 50\text{£.}; \text{ and } 4000\text{s.} \div 8 = 500\text{s.} = 25\text{£.}; \text{ then, } 50\text{£.} + 25\text{£.} = 75\text{£.}, \text{ Ans.}$

¶ 140. EXAMPLES FOR PRACTICE.

2. $3 \text{ qts.} = 2 \text{ qts.} + 1 \text{ qt.}; \$94 \div 2 = \$47, \text{ the price of } 2 \text{ qts.}, \text{ and } \$94 \div 4, \text{ or } \$47 \div 2, = \$235, \text{ the price of } 1 \text{ qt.}; \text{ then, } \$47 + \$235 = \$70\frac{1}{2}, \text{ Ans.}$

3. $90 \text{ rds.} = 80 \text{ rds.} (= \frac{1}{4} \text{ mi.}) + 10 \text{ rds.} (= \frac{1}{2} \text{ mi.} = \frac{1}{2} \text{ of } \frac{1}{4} \text{ mi.};) \$1200 \div 4 = \$300, \text{ and } \$1200 \div 32, \text{ or } \$300 \div 8, = \$37\cdot50; \text{ then, } \$300 + \$37\cdot50 = \$337\cdot50, \text{ Ans.}$

4. $65 \text{ lbs.} = 40 \text{ lbs.} (= \frac{1}{2} \text{ bar.}) + 25 \text{ lbs.} (= \frac{1}{4} \text{ bar.};) \$17\cdot25 \div 5 = \$3\cdot45, \text{ and } \$17\cdot25 \div 8 = \$2\cdot15+; \text{ then, } \$3\cdot45 + \$2\cdot15+ = \$5\cdot60+, \text{ Ans.}$

5. $14 \text{ quires} = 10 \text{ quires} (= \frac{1}{2} \text{ ream}) + 4 \text{ quires} (= \frac{1}{4} \text{ ream};) \$3\cdot00 \div 2 = \$1\cdot50, \text{ and } \$3\cdot00 \div 5 = \$\cdot60; \text{ then, } \$1\cdot50 + \$\cdot60 = \$2\cdot10, \text{ Ans.}$

8. $8 \text{ mo.} = 6 \text{ mo.} (= \frac{1}{2} \text{ yr.}) + 2 \text{ mo.} (= \frac{1}{3} \text{ of } \frac{1}{2} \text{ yr.}) \text{ and } 21 \text{ d.} = 15 \text{ d.} (= \frac{1}{2} \text{ of } 2 \text{ mo.}) + 6 \text{ d.} (= \frac{1}{10} \text{ of } 2 \text{ mo.};) \$400 \div 2 = \$200, \$200 \div 3 = \$66\frac{2}{3}, \$66\frac{2}{3} \div 4 = \$16\frac{2}{3}, \text{ and } \$66\frac{2}{3} \div 10 = \$6\frac{2}{3}; \text{ then, } \$200 + \$66\frac{2}{3} + \$16\frac{2}{3} + \$6\frac{2}{3} = \$290, \text{ Ans.}$

9. $5 \text{ C. ft.} = 4 \text{ C. ft.} (= \frac{1}{2} \text{ C.}) + 1 \text{ C. ft.} (= \frac{1}{4} \text{ of } \frac{1}{2} \text{ C.}) \text{ and } 12 \text{ cu. ft.} = 8 \text{ cu. ft.} (= \frac{1}{2} \text{ C. ft.}) + 4 \text{ cu. ft.} (= \frac{1}{2} \text{ of } \frac{1}{2}$

C. ft.): $\$2.50 \div 2 = \1.25 , $\$1.25 \div 4 = \$31\frac{1}{4}$, $\$31\frac{1}{4} \div 2 = \$15\frac{1}{8}$, which $\div 2 = \$7\frac{1}{16}$; then, $\$1.25 + \$31\frac{1}{4} (=) \frac{1}{16} + \$15\frac{1}{8} (=) \frac{1}{8} + \$7\frac{1}{16} = \$179\frac{1}{16}$, *Ans.*

10: 11 oz. = 8 oz. ($= \frac{1}{2}$ lb.) + 2 oz. ($= \frac{1}{2}$ of $\frac{1}{2}$ lb.) + 1 oz. ($= \frac{1}{2}$ of 2 oz.): $\$12 \div 2 = \6 , $\$6 \div 4 = \1.50 , which $\div 2 = \$0.75$; then, $\$6 + \$1.50 + \$0.75 = \8.25 , *Ans.*

11. 3 yds. = 3 times 1 yd., and $\frac{1}{3}$ yd. = $\frac{1}{3}$ yd. + $\frac{1}{3}$ yd. ($= \frac{1}{3}$ of $\frac{1}{3}$ yd.): $\$4.00 \times 3 = \12.00 , $\$4.00 \div 2 = \2.00 , which $\div 4 = \$0.50$; then, $\$12.00 + \$2.00 + \$0.50 = \14.50 , *Ans.*

¶ 141. EXAMPLES FOR PRACTICE.

1. 9s. = '45£., and 7d. = '029£. *Ans.* '479£. — 12s. = '6£., and $\frac{1}{2}$ d. = '003£. *Ans.*, '603£.

2. 15s. = '75£., and 3d. = '012£.; 8s. = '4£., and $11\frac{1}{2}$ d. = '048£.; 10s. = '5£., and $6\frac{1}{2}$ d. = '026£.; 1s. = '05£., and $8\frac{1}{2}$ d. = '035£.; $\frac{1}{2}$ d. = '002£.; $2\frac{1}{2}$ d. = '009£. *Amount*, £1'833.

¶ 142. 1. *It will be most convenient to decompose the fraction in the following manner:* '5£. = 10s., and '023£. = 22 (abating 1) = 22qr. = $5\frac{1}{2}$ d. *Ans.*, 10s. $5\frac{1}{2}$ d. — '694£. (= '66£.) = 13s. + ('044£. =) 42 (abating 2) = 42 qr. = $10\frac{1}{2}$ d. *Ans.*, 13s. $10\frac{1}{2}$ d.

2. '45£. = 9s., and '020£. = $4\frac{1}{2}$ d. *Ans.*, 9s. $4\frac{1}{2}$ d.

3. '75£. = 15s., and '035£. = 34qr. = $8\frac{1}{2}$ d.; '35£. = 7s., and '007£. = $1\frac{1}{2}$ d.; '9£. = 18s., and '016£. = $3\frac{1}{2}$ d.; '7£. = 14s., and '040£. = $9\frac{1}{2}$ d.; '5£. = 10s.; '25£. = 5s.; '05£. = 1s., and '040£. = $9\frac{1}{2}$ d.; '008£. = 2d. *Amount*, 3£. 12s. 11d.

PERCENTAGE.

¶ 143. EXAMPLES FOR PRACTICE.

4. 895 lbs. \times '09 = 80'55 lbs., and 895 lbs. — 80'55 lbs. = 814'45 lbs., *Ans.*

5. 725 bar. \times '28 = 203 bar. thrown overboard, and 725 bar. — 203 bar. = 522 bar. saved, *Ans.*

6. '125 of any sum or number = $\frac{1}{8}$ of the sum or number; hence, $\$692.75 \div 8 = \$86.59\frac{3}{4}$, *Ans.*

7. $33\frac{1}{3}$ per cent. = $\frac{1}{3}$ of the whole number; hence, 639 sheep + ($\frac{2}{3}$ of 639 =) 213 sheep = 852 sheep, *Ans.*

8. $\$1942.715 \times .16375 = \$318.1195+$, the sum paid, and $\$1942.715 - \$318.1195+ = \$1624.595+$, *Ans.*

9. $\$4861 \times .285 = \1385.385 , *Ans.*

10. $\$115 \times .0075 = \$862\frac{1}{2}$, *Ans.*

11. $\$376 \times .00875 = \3.29 , *Ans.*

13. $\$1960 \times .22 = \431.20 , due in 3 mo., and $\$1960 - \$431.20 = \$1528.80$, due in 6 mo., *Ans.*

15. 100 per cent. — 63 per cent. = 37 per cent., the loss; then, $\$3615 \times .37 = \1337.55 , *Ans.*

16. At each transaction he saves 85 per cent. of what he has before the transaction. $\$5000 \times .85 = \4250 , the value of the farm; $\$4250 \times .85 = \3612.50 , what he receives for the farm; $\$3612.50 \times .85 = \3070.625 , what he has left after his excursion to the west; $\$3070.625 \times .85 = \$2610.031\frac{1}{2}$, what he has left after speculating in railroad stocks; and $\$2610.031\frac{1}{2} \times .85 = \$2218.526+$, what he has left on quitting trade, *Ans.*

Mutual Insurance.

¶ 145. EXAMPLES FOR PRACTICE.

2. $\$2845 \times .12 = \341.40 , am't of the premium note, $10\frac{1}{2}$ per cent. of which = $\$35.847$, *Ans.*

3. $\$2845 \times .15 = \426.75 , am't of premium note, $10\frac{1}{2}$ per cent. of which = $\$44.808\frac{1}{2}$, *Ans.*

4. $\$5000 \times .22 = \1100 , am't of premium note, 7 per cent. of which = $\$77$, cost of 5 years insurance, and $\$77 \div 5 = \15.40 , cost per year, *Ans.*

5. $\$3200 \times .11 = \352 , am't of premium note, $10\frac{1}{2}$ per cent. of which = $\$35.49\frac{1}{2}$, the whole sum paid, *Ans.*

6. $\frac{1}{2}$ per cent. of $\$3200 = \16 , the cost of insurance for 1 year, and $\$16 \times 5 = \80 , the cost for 5 years; then $\$80 - \$35.49\frac{1}{2} = \$44.50\frac{1}{2}$, *Ans.*

7. $\$750 \times .06 = \45 , am't of premium note, $13\frac{1}{2}$ per cent. of which = $\$6.07\frac{1}{2}$, cost of 5 years' insurance, and $\$6.07\frac{1}{2} \div 5 = \$1.21\frac{1}{2}$, cost of 1 year's insurance, *Ans.*

8. $\$900 \times .05 = \45 , am't of premium note, 6 per cent. of which = $\$2.70$, *Ans.*

Stocks.

¶ 146. EXAMPLES FOR PRACTICE.

1. $\$100 \times 35 \times (\frac{1}{100}) = 1.20 = \4200 , *Ans.*

2. 100 per cent. $+ 7\frac{1}{2}$ per cent. $= 107\frac{1}{2}$ per cent.; then,
 $\$100 \times 15 \times 1.075 = \1612.50 , *Ans.*

3. $(100 - 1\frac{1}{4}) = 98\frac{3}{4}$ per cent.; then, $\$2000 \times .9875 =$
 $\$1975$, *Ans.*

4. $(100 - 11\frac{1}{4}) = 88\frac{3}{4}$ per cent.; then, $\$2800 \times .8875 =$
 $\$2485$, *Ans.*

6. $(100 + 9\frac{1}{2}) = 109\frac{1}{2}$ per cent.; $\$3000 \times 1.095 = \3285 ,
Ans.

7. $(100 - 1\frac{1}{2}) = 98\frac{1}{2}$ per cent.; $\$5000 \times .985 = \4925 ,
Ans.

Brokerage.

¶ 147. EXAMPLES FOR PRACTICE.

4. $\$5000 \times .0025 = \12.50 , the brokerage, and $\$5000$
 $+ \$12.50 = \5012.50 , *Ans.*

6. $\$6000 \times 1.01 = \60 , *Ans.*

7. $\$5200 \times .005 = \26 , and $\$5200 - \$26 = \$5174$,
Ans.

Profit and Loss.

¶ 148. EXAMPLES FOR PRACTICE.

2. $\$60 \times .20 = \12 , the gain, and $\$60 + \$12 = 72$,
Ans.; or, I must sell it for $\frac{4}{3}$ of what it cost me, that is, for
 120 per cent. of $\$60$; $\$60 \times 1.20 = \72 , *Ans.*, as before.

3. I must sell it for $(100 - 12) = 88$ per cent. of what it
 cost me; $\$2.50 \times .88 = \2.20 , *Ans.*

4. To gain 5 per cent., I must sell it for 105 per cent. of
 what it cost me, that is for 5 per cent. advance; $\$.20 \times 1.05$
 $= \$.21$, *Ans.*, &c. To gain 10 per cent., I must sell it for
 110 per cent. of $\$.20 = \$.22$, *Ans.* To gain 15 per cent., I
 must sell it for 115 per cent. of $\$.20 = \$.23$, *Ans.* To lose
 20 per cent., I must sell it for $(100 - 20) = 80$ per cent. of
 $\$.20 = \$.16$, *Ans.*

Interest.

¶ 150. EXAMPLES FOR PRACTICE.

2. $\$450 \times .05 = \22.50 , the interest for 1 year, which \div
 $4 = \$5.62\frac{1}{2}$, the interest for ($\frac{1}{4}$ yr. $=$) 3 months, and $\$5.62\frac{1}{2}$
 $\times 3 = \$16.87\frac{1}{2}$, the interest for ($\frac{3}{4}$ yr. $=$) 9 months; then,
 $\$450 + \$16.87\frac{1}{2} = \$466.87\frac{1}{2}$, the amount, *Ans.*

3. $\$87.50 \times .08 = \7 , interest for 1 yr., which $\div 2 =$

\$3.50, interest for 6 mo.; and $\$3.50 \div 6 = \$583+$, interest for 1 mo.; then, $\$3.50 + \$583+ = \$1053+$, interest for 7 mo., and $\$7.50 + \$4083+ = \$91583+$, *Ans.*

4. $\$163 \times .07 = \11.41 , interest for 1 yr., which $\div 3 = \$3803+$, interest for 4 mo., *Ans.*

5. $\$850 \times .06 = \51 , interest for 1 yr., which $\div 6 = \$850$, interest for 2 mo., and $\$850 \times 5 = \4250 , interest for 10 mo., *Ans.*

¶ 151. EXAMPLES FOR PRACTICE.

2. $\$400 \times .03 = \32 , interest for 1 yr.; $\$32 \div 4 = \8 , interest for 3 mo.; and $\$8 \div 10 = \80 , interest for 9 days, *Ans.* NOTE. 9 days $= \frac{9}{30} = \frac{1}{10}$ of 3 months.

3. $\$75 \times .08 = \6 , for 1 yr.; $\$6 \div 12 = \50 , for 1 mo.; $\$50 \div 2 = \25 , for 15 d.; $\$50 \div 15 = \$3\frac{1}{3}$, for 2 d.; which $\times 2 = \$6\frac{2}{3}$, for 4 d.; then, $\$25 + \$6\frac{2}{3} = \$31\frac{2}{3}$, for 19 d., *Ans.*

4. $\$500 \times .08 = \40 , for 1 yr.; $\$40 \div 12 = \$33\frac{1}{3}$, for 1 mo.; $\$33\frac{1}{3} \div 6 = \$55\frac{1}{6}$, for 5 d., which $\times 5 = \$277\frac{1}{2}$, for 25 d., *Ans.*

¶ 152. EXAMPLES FOR PRACTICE.

1. $\$84 \times .03 = \6.72 , for 1 yr.; $\$6.72 \div 4 = \1.68 , for 3 mo., which $\times 3 = \$5.04$, for 9 mo.; $\$1.68 \div 9 = \$18\frac{2}{3}$, for 10 d., which $\times 2 = \$37\frac{1}{3}$, for 20 d.; then, $\$6.72 + \$5.04 + \$37\frac{1}{3} = \$12133+$, *Ans.*

2. $\$147 \times .07 = \10.29 , for 1 yr., which $\times 2 = \$20.58$, for 2 yrs.; $\$10.29 \div 6 = \$1.71\frac{1}{2}$, for 2 mo., which $\times 4 = \$6.86$, for 8 mo.; $\$1.71\frac{1}{2} \div 5 = \343 , for 12 d.; then, $\$20.58 + \$6.86 + \$343 = \27783 , *Ans.*

3. $\$248 \times .09 = \22.32 , for 1 yr., which $\times 2 = \$44.64$, for 2 yrs.; $\$22.32 \div 2 = \11.16 , for 6 mo.; and $\$11.16 \div 9 = \1.24 , for 20 d.; then, $\$44.64 + \$11.16 + \$1.24 = \5701 , *Ans.*

4. $\$161.08 \times .07 = \11.2756 , for 1 yr.; $\$11.2756 \div 12 = \$9396\frac{1}{3}$, for 1 mo., which $\times 11 = \$103359\frac{2}{3}$, for 11 mo.; $\$9396\frac{1}{3} \div 2 = \$4698\frac{1}{6}$, for 15 d.; $\$9396\frac{1}{3} \div 10 = \$9396\frac{1}{3}$, for 3 d., which $\div 3 = \$3132\frac{1}{3}$, for 1 d.; the sum of the interests for 11 mo., 15 d., 3 d. and 1 d. $= \$10931+$, *Ans.*

5. $\$73.25 \times .08 = \5.86 , for 1 yr.; $\$5.86 \div 4 = \1.465 , for 3 mo., which $\times 3 = \$4.395$, for 9 mo.; $\$5.86 \div 6 = \$976\frac{2}{3}$, for 2 mo., which $\div 5 = \$195\frac{1}{5}$, for 12 d.; the sum of the interest for 1 yr. 9 mo. 12 d. $= \$1045+$, *Ans.*

6. $\$910.50 \times .07 = \63.735 , for 1 yr., which $\times 3 =$

\$191.205, for 3 yrs.; $\$63.735 \div 4 = \$15.933\frac{1}{4}$, for 3 mo., which $\times 3 = \$47.801\frac{1}{4}$, for 9 mo.; $\$15.933\frac{1}{4} \div 3 = \$5.311\frac{1}{4}$, for 1 mo., which $\div 3 = \$1.770\frac{1}{12}$, for 10 d.; and $\$1.770\frac{1}{12} \times 2 = \$3.540\frac{1}{6}$, for 20 d., and $\$5.311\frac{1}{4} \div 5 = \$1.062\frac{1}{4}$, for 5 d.; the sum of the interest for 3 years 9 mo. 20 d. and 6 d. = $\$243.609+$, *Ans.*

7. $\$185.26 \times .075 = \$13.894\frac{1}{2}$, for 1 yr., which $\times 2 = \$27.789$, for 2 yrs.; $\$13.894\frac{1}{2} \div 4 = \$3.473\frac{3}{8}$, for 3 mo.; $\$3.473\frac{3}{8} \div 9 = \$385\frac{1}{2}$, for 10 d., which $\div 10 = \$0.38+$, for 1 d.; the sum of the interests for 2 yrs. 3 mo. 10d. and 1 d. = $\$31.687+$, which $+$ $\$185.26 = \$216.947+$, *Ans.*

9. $\$46.28 \times .05 = \2.314 , for 1 yr., which $\times 2 = \$4.628$, for 2 yrs.; $\$2.314 \div 4 = \5785 , for 3 mo.; $\$5785 \div 9 = \$06427+$, for 10 d., which $\div 10 = \$006427+$, for 1 d.; and the interest for 1 d. $\times 23 = \$1478+$, for 23 d.; the sum of the interests for 2 yrs. 3 m. and 23 d. = $\$5.354+$, *Ans.*

10. $\$175.25 \times .06 = \10.515 , for 1 yr., which $\times 5 = \$52.575$, for 5 yrs.; $\$10.515 \div 12 = \$876\frac{1}{4}$, for 1 mo., which $\times 8 = \$7.01$, for 8 mo.; $\$876\frac{1}{4} \div 5 = \$175\frac{1}{4}$, for 6 d., which $\times 3\frac{1}{2}$ (6 d. $\times 3\frac{1}{2} = 21$ d.) = $\$613\frac{3}{8}$, for 21 d.; the sum of the interests for 5 yrs. 8 mo. and 21 d. $+$ $\$175.25 = \$235.448+$, *Ans.*

11. $\$96.50 \div 8 = \$12.06\frac{1}{4}$, for 1 yr., which $\times 2 = \$24.12\frac{1}{2}$, for 2 yrs.; $\$12.06\frac{1}{4} \div 12 = \$1.0052\frac{1}{12}$, for 1 mo., which $\div 30 = \$0.335+$, for 1 d.; then, $\$24.125 - \$0.335 = \$24.091+$, for 1 yr. 11 mo. 29 d.; and $\$96.50 + \$24.091 = \$120.591+$, *Ans.*

12. $\$54.81 \times .05 = \2.7405 , for 1 yr., which $\div 2 = \$1.37025$, for 6 mo.; whence, $\$4.11+$, *Ans.*

13. $\$500 \times .08 = \40 , for 1 yr.; $\$40 \div 4 = \10 , for 3 mo., which $\times 3 = \$30$, for 9 mo.; $\$10 \div 10 = \1 , for 9 days; then, $\$30 + \$1 = \$31$, *Ans.*

14. $\$62.12 \times .04 = \2.4848 , for 1 yr., which $\div 12 = \$2070\frac{3}{4}$, for 1 mo.; and $\frac{2}{3}$ of $\$2070\frac{3}{4} = \$1380\frac{1}{2}$, for 20 d.; then, $\$2070\frac{3}{4} + \$1380\frac{1}{2} = \$345+$, *Ans.*

15. $\$85 \div 8 = \10.625 , for 1 yr.; 10 mo. 15 d. = $\frac{7}{8}$ of 1 yr.; then, $\$10.625 - (\frac{1}{8} \text{ of } \$10.625) = \$1.328\frac{1}{4} = \$9.296+$, *Ans.*

16. $\$53 \times .10 = \5.30 , for 1 yr., which $\div 2 = \$2.65$, for 6 mo.; $\$2.65 \div 6 = \$441\frac{2}{3}$, for 1 mo.; and $\$2.65 + \$441\frac{2}{3} + \$53 = \$56.091+$, *Ans.*

23. $\$57.78 \times .04 = \2.3112 , for 1 year; $\$2.3112 \div 3 = \7704 , for 4 mo.; $\$7704 \div 8 = \963 , for 15 d., $\frac{1}{15}$ of

which = \$01254, for 2 d.; the sum of the interest for 1 yr. 4 mo. 15 d. and 2 d. = \$3.19+, *Ans.*

24. From May 19th, 1847, till Aug. 11th, 1848, is 1 yr. 2 mo. 22 d.; $\$298.59 \times .08 = \23.8972 , for 1 yr.; $\$23.8972 \div 6 = \3.9812 , for 2 mo.; $\$3.9812 \div 3 = \$1.32706+$, for 20 d., which $\div 10 = \$1.327+$, for 2 d.; the sum of the interests for 1 yr. 2 mo. 20 d. and 2 d. = $\$29.328+$, which + $\$298.59 = \$327.918+$, *Ans.*

25. From June 14th, 1847, till April 29th, 1848, is 10 mo. 15 d. = $\frac{1}{2}$ yr.; $\$196 \times .0575 = \11.27 , for 1 yr.; and $\$11.27 - (\frac{1}{2} \text{ of } \$11.27) = \$1.40\frac{1}{2} = \$9.86\frac{1}{2}$, for 10 mo. 15 d.; then, $\$196 + \$9.86\frac{1}{2} = \$205.861\frac{1}{2}$, *Ans.*

¶ 151. EXAMPLES FOR PRACTICE.

3. $\$194 \times .022 = \4.268 , *Ans.*
4. $\$263.48 \times .0135 = \$3.556+$, *Ans.*
5. $\$985 \times .34 = \334.90 , which + $\$985 = \1319.90 , *Ans.*
6. $\$57.19 \times .075 = \$6.539+$, *Ans.*
7. $\$116.08 \times .058\frac{1}{2} = \$6.751+$, *Ans.*
8. $\$200 \times .040\frac{2}{3} = \$8.133+$, *Ans.*
9. $\$.65 \times .095 = .08+$, *Ans.*
10. $\$.850 \times .107 = \$.909+$, *Ans.*
11. $\$.675 \times .0085 = \$.5737+$, *Ans.*
12. $\$.8373 \times .001\frac{2}{3} = \$.14455$, *Ans.*
13. $\$.73 \times .05 = \$.036+$, *Ans.*
14. $\$.12646 \times .045 = \$.569+$, *Ans.*
15. $\$.318 \times .052\frac{2}{3} = \$.16748$, *Ans.*
16. $\$.418 \times .097\frac{2}{3} = \$.40894+$, *Ans.*
17. $\$.26844 \times .209\frac{1}{3} = \$.56193+$, *Ans.*
18. $\$.658 \times .045 = \$.2961$, *Ans.*
19. $\$.96 \times .0005 = \$.048$; or, $\$.096 \div 2 = \$.048$, *Ans.*, as before.
20. $\$.7350 \times .000\frac{1}{3} = \$.0245$; or, $\$.0735 \div 3 = \$.0245$, *Ans.*, as before.
21. 5 days = $\frac{1}{3} + \frac{1}{3}$ of 6 days; therefore, $\$.180$ (making no account of the cents) $\div 3$ and by 2 (and uniting the two quotients) = $\$.15$, *Ans.*
22. $\$.15000 \times .000\frac{1}{3} = \$.250$; or, $\$.15 \div 6 = \$.250$, *Ans.*, as before.

¶ 155. 2. $\$1000 \times .06 = \60 , which $\times 120 = \$7200$, *Ans.*

3. The int. for 10 years is \$240; $\$400 \times .016 = \6.40 for 3 mo. 6 days.; then, $\$210 + 6.40 = \246.40 , *Ans.*

6. The int. for 9 yrs. is \$405; $\$750 \times .0221\frac{1}{2} = \16.75 for 4 mo. 14 d.; then, $\$750 + \$405 + \$16.75 = \1171.75 , *Ans.*

¶ 156. 1. $36.477\text{£} \times .06 = 2.18\text{£} + \text{£} = 2\text{£} \text{ } 3\text{s} \text{ } 9\text{d.}$, *Ans.*

2. $36.5\text{£} \times .093\frac{1}{2} = 3.406\text{£} + \text{£} = 3\text{£} \text{ } 8\text{s} \text{ } 1\frac{1}{2}\text{d.}$, *Ans.*

4. $18.6\text{£} \times .0505 = .939\text{£}$, which $+ 18.6\text{£} = 19.539\text{£}$, *Ans.*

7. $640.4\text{£} \times .06 = 38.424\text{£}$, (int. for 1 yr.,) which $+ 640.4\text{£} = 678.824\text{£} = 678\text{£} \text{ } 16\text{s} \text{ } 5\frac{1}{2}\text{d.}$, amount for 1 yr.; $38.424\text{£} \times 2\frac{1}{2} = 96.06\text{£}$, (int. for $2\frac{1}{2}$ yrs.,) which $+ 640.4\text{£} = 736.46\text{£} = 736\text{£} \text{ } 9\text{s} \text{ } 2\frac{1}{2}\text{d.}$, amount for 2 yrs. 6 mo., &c.

8. $391.85\text{£} \times .045 = 17.63325\text{£}$, (int. for 1 yr.,) which $\times 3 = 52.89975\text{£}$, (int. for 3 yrs.,) $17.63325\text{£} + 4 = 4.40831\text{£}$, (interest for 3 mo.,) then, $391.85\text{£} + 52.89975\text{£} + 4.40831\text{£} = 449.158\text{£} + \text{£} = 449\text{£} \text{ } 3\text{s} \text{ } 2\text{d.}$

9. 8 mo. 18 d. = the time; $235.188\text{£} \times .0525 = 12.34737\text{£}$, (int. for 1 yr.,) $\frac{2}{3}$ of which $= 8.23158\text{£}$, (int. for 8 mo.,) $\frac{1}{10}$ of $12.34737\text{£} = .61736\text{£}$, (int. for 18 d.,) then, $235.188\text{£} + 8.23158\text{£} + .61736\text{£} = 244.036\text{£} + \text{£} = 244\text{£} \text{ } 8\frac{1}{2}\text{d.}$, *Ans.*

¶ 157. To calculate interest on notes, &c., when partial payments have been made.

2. First principal on int. from March 8th, 1843, \$567.33
Payment, Apr. 16th, 1843, (exceeding

int. due,) \$136.44

Int. to time of 1st payment, (1 mo. 8 d.,) 6.408 130.032

Remainder for a new principal, \$737.298

Payment, Apr. 16th, 1845, \$319

Int. to time of 2d payment, (2 yrs.,) 103.221 215.779

Remainder for a new principal, \$521.519

Payment, Jan. 1st, 1846, \$518.68

Int. to time of 3d payment, (8 mo. 15 d.,) 25.858 492.822

Remainder for a new principal, \$28.697

Int. to July 11th, 1847, (1 yr. 6 mo. 10 d.,) 3.068

Balance due July 11th, 1847, \$31.765+.

3. First principal on int. from Jan. 1st, 1840,		\$1000
Payment, Apr. 1st, 1840,	\$24	
Int. to time of 1st payment, (3 mo.)	15	9
	—	—
Remainder for a new principal,		\$991
Payment, Aug. 1st, 1840, less than int.		
then due,	\$4	
Payment, Dec. 1st, 1840, less than int.		
then due,	6	
Payment, Feb. 1st, 1841,	60	
	—	—
Amount, exceeding int. due,	\$70	
Int. to time of 4th payment, (10 mo.)	49·55	20·45
	—	—
Remainder for a new principal,		\$970·55
Payment, July 1st, 1841,	\$40	
Int. to time of 5th payment, (5 mo.)	24·263	15·737
	—	—
Remainder for a new principal,		\$954·813
Payment, June 1st, 1844,	\$300	
Int. to time of 6th payment, (2 yrs.		
11 mo.)	167·092	\$132·908
	—	—
Remainder for a new principal,		\$821·905
Payment, Sept. 1st, 1844, less than int.		
then due,	\$12	
Payment, Jan. 1st, 1845, less than int.		
then due,	15	
Payment, Oct. 1st, 1845,	50	
	—	—
Amount, exceeding int. due,	\$77	
Int. to time of 9th payment, (1 yr.		
4 mo.)	65·752	11·248
	—	—
Remainder for a new principal,		\$810·657
Int. to June 1st, 1846, (8 mo.)		32·426
		—
Balance due June 1st, 1846,		\$843·083+.
4. Amount of \$300, for 11 mo. 22 d.,		\$323·466
Amount of \$116, for 4 mo. 12 d.,	\$119·402	
Amount of \$49·50, for 3 mo.,	50·49	
Amount of \$85, for 1 mo. 6 d.,	85·68	255·572
	—	—
Balance due June 2d, 1847,		\$67·894+.

¶ 158. CONNECTICUT METHOD.

First principal on int. from Jan 1st, 1841,		\$1100
Payment, Sept. 1st, 1841, less than int. then due,	\$30	
Payment, Apr. 1st, 1842,	200	
	<hr/>	
Amount, exceeding int. due,	\$230	
Int. to time of 2d payment, (1 yr. 3 mo.,)	82·50	147·50
	<hr/>	
Remainder for a new principal,		\$952·50
Payment, Dec. 1st, 1842,	\$180	
Int on 3d payment, (4 mo.,)	3·60	
	<hr/>	
Amount of 3d payment,	\$183·60	
Int. on prin. to Apr. 1st, 1843, (1 yr.,)	57·15	126·45
	<hr/>	
Remainder for a new principal,		\$826·95
Payment, March 1st, 1844,	\$195	
Int. on 4th payment, (1 mo.,)	975	
	<hr/>	
Amount of 4th payment,	\$195·975	
Int. on prin. to Apr. 1st, 1844, (1 yr.,)	49·563	146·412
	<hr/>	
Remainder for a new principal,		\$679·638
Payment, Sept. 16th, 1844,	\$250	
Int. on 5th payment, (6 mo. 15 d.,)	8·125	
	<hr/>	
Amount of 5th payment,	\$258·125	
Int. on prin. to Apr. 1st, 1845, (1 yr.,)	40·778	217·347
	<hr/>	
Remainder for a new principal,		\$462·291
Payment, May 16th, 1846,	\$100	
Int. on prin. to May 16, 1846, (1 yr. 1½ mo.,)	31·204	66·796
	<hr/>	
Remainder for a new principal,		\$393·495
Payment, July 16th, 1846,	\$170	
Int. on 7th payment, (6 mo.,)	5·10	
	<hr/>	
Amount of 7th payment,	\$175·10	
Int. on prin. to Jan. 16th, 1847, (8 mo.,)	15·739	159·361
	<hr/>	
Balance due Jan. 16th, 1847,		\$234·134+

¶ 159. For calculating interest on a note in Vermont.

EXAMPLE.	Amount of \$500, for 5 years,	\$1040
	Amount of \$200, for 3 yrs. 2 mo.,	\$238
	" " \$200, " 1 yr. 8 mo.,	220
	" " \$300, " 1 "	318
		<hr/>
	Balance due Sept. 1st, 1845,	\$264

¶ 161. Compound Interest.

2. \$1 at 6 per cent., by the table, for 4 years, is \$1·26247+, which $\times 40\cdot20$ (a decimal number = to the principal) = \$50·751+, the amount of \$40·20 for 4 yrs., &c. \$3·20173+ (the amount of \$1 for 20 yrs. at 6 per cent.) $\times 40\cdot20$ = \$128·9266+, (amount of 40·20 for 20 yrs.) which $\times 1\cdot033$ (the amount of \$1 for 6 mo. 18 d.) = \$133·151+, *Ans.*

3. The amount of \$1, at 7 per cent., by the table, for 16 years, is \$2·95216+, which $\times 750$ = \$2214·12, *Ans.*

4. The amount of \$1, at 8 per cent., for 20 years, is \$4·629219+, which $\times 150$ = \$694·382+, *Ans.*

¶ 162. Annual Interest.

2.	Interest on the principal, \$1000, 5 yrs. 3 mo.,	\$315
	" " 1st year's int. (\$60) 4 " 3 "	15·30
	" " 2d " " " 3 " 3 "	11·70
	" " 3d " " " 2 " 3 "	8·40
	" " 4th " " " 1 yr. 3 "	4·50
	" " 5th " " " 3 "	·90
		<hr/>

Amount of interest, \$355·50

Then, \$1000 + \$355·50 = \$1355·50, amount due, *Ans.*

Time, rate, and amount given, to find the principal.

¶ 163. 2. $\$85\cdot12 \div \$1\cdot12$ (amount of \$1, at given rate and time) = \$76, *Ans.*

3. $\$99\cdot311 \div \$1\cdot0565$ = \$94, *Ans.*

4. $\$1500 \div \$1\cdot05$ (amount of \$1 for 4 mo., at 15 per cent.) = \$1428·571+, value of the wheat, *Ans.*

Discount.

¶ 164. 3. $\$18 \div \$1\cdot075$ = \$16·744+, *Ans.*

4. $\$56\cdot20 \div \$1\cdot10$ = \$51·09+, present worth, discount-

ing at 6 per cent. — $\$56\cdot20 \div \$1\cdot15 = \$48\cdot869+$, present worth, discounting at 9 per cent., *Ans.*

5. $\$834 \div \$1\cdot112$ (amount of \$1, at given rate and time) = $\$750$, *Ans.*

6. $\$321\cdot63 \div \$1\cdot24 = \$259\cdot379+$, (the present worth,) and $\$321\cdot63 - \$259\cdot379 = \$62\cdot25+$, *Ans.*

7. $\frac{1}{2}$ of $\$650 = \325 , which $\div \$1\cdot02$ (am't of \$1 for 4 mo.) = $\$318\cdot6274+$, and $\$325 \div \$1\cdot04$ (am't of \$1 for 8 mo.) = $\$312\cdot50$; then, $\$318\cdot6274 + \$312\cdot50 = \$631\cdot1274$, and $\$650 - \$631\cdot1274 = \$18\cdot872+$, *Ans.*

8. $\$5378 \div \$1\cdot06 = \$5073\cdot5849+$, the value of the goods; $\$5073\cdot584 \times \cdot035 = \$177\cdot575+$, the interest on the purchase money 6 mo., at 7 per cent.; $\$5378 - \$5073\cdot5849 = \$304\cdot415+$, the difference between the cash price of the goods and the sum paid for them on 6 mo. credit; $\$304\cdot415 - \$177\cdot575 = \$126\cdot84$, gain on one purchase, which $\times 50$ (the number of purchases in 20 years) = $\$6342$, *Ans.*

Commission.

¶ 165. 2. $\$2475 \div \$1\cdot05 = \$2357\cdot1428+$, to be paid out, and $\$2475 - \$2357\cdot1428 = \$117\cdot857+$, *Ans.*

3. $\$4820 \div \$1\cdot075 = \$4483\cdot72+$, to be paid out, and $\$4820 - \$4483\cdot72 = \$336\cdot28$, amount of his commission, *Ans.*

¶ 163. EXAMPLES FOR PRACTICE.

2. $\$4\cdot52 \div \$08 = \$56\cdot50$, *Ans.*

3. $\$20 \div \$06 = \$333\cdot333\frac{1}{3}$, *Ans.*

4. $\$562 \div \$10 = \$5620$, *Ans.*

¶ 167. *Principal, interest, and time given, to find the rate per cent.*

EXAMPLES FOR PRACTICE.

2. The interest of \$468 1 year, at 1 per cent., is \$4·68, which $\div 12 = \$39$, the interest, at 1 per cent., 1 month; then, $\$2\cdot34 \div \$39 = 6$ per cent., *Ans.*

3. $\$46\cdot80 \div \$10\cdot40 = 4\frac{1}{2}$ per cent., *Ans.*

4. 1 per cent. of \$1000 (the value of the stock) = \$10; then, \$100 (yearly dividend) $\div \$10 = 10$ per cent., *Ans.*

5. 1 per cent. of \$5400 = \$54; then, $\$324 \div \$54 = 6$ per cent., *Ans.*

¶ 168. EXAMPLES FOR PRACTICE.

2. The interest on \$226.50, 1 year, is \$13.59; therefore, $\$31.71 \div \$13.59 = 2.33\frac{1}{2}$ years = 2 years and 4 months, *Ans.*

3. $\$20 \div \48 (int. 1 year) = $.416\frac{2}{3}$ years = 5 months, *Ans.*

4. $\$28.242 \div \$8.69 = 3.25$ years, very nearly = 3 years 3 months, *Ans.*

¶ 169. EXAMPLES FOR PRACTICE.

2. $\frac{12}{100} = .12 = 12$ per cent., *Ans.*

3. $\frac{7}{100} = .07 = 7$ per cent.; $\frac{4.5}{100} = .045 = 4\frac{1}{2}$ per cent.; $\frac{.5}{100} = .005 = \frac{1}{2}$ per cent., *Ans.*

4. $\$1.0032 - \$.96 = \$.0432$, (gain per gal.,) which $\times 114 = \$4.9248$, the whole gain; and $\frac{4.5}{100} = .045 = 4\frac{1}{2}$ per cent., *Ans.*

5. $\$26 \times 30 = \780 , which $- \$698.33$ (first cost and charges) = $\$81.67$; then, $\frac{81.67}{698.33} = .11695 = 11.695$ per cent., *Ans.*

7. $\frac{2.5}{1000} = .0025 = \frac{1}{4}$ per cent., *Ans.*

Bankruptcy.

¶ 170. EXAMPLES FOR PRACTICE.

1. If \$300000 be divided into 800000 equal parts, 1 of the parts will be the sum paid on \$1. $\$300000 \div 800000 = \$37\frac{1}{2}$, that is, $37\frac{1}{2}$ per cent., *Ans.*

3. $\$4653 \div \6755.50 (amount of his debts) = $\$.681111\bar{1}$ = the sum paid on \$1; this sum, (which is the rate per cent. paid to his creditors,) multiplied by the amount of each man's claim, will give his respective share. *Ans.*, A will receive \$172.193; B, \$220.407; C, \$344.386; D, \$123.978; E, \$482.14; F, \$268.621; G, \$45.114; H, \$895.403; I, \$1515.298; and J, \$585.456.

¶ 171. General Average.

$\$3476.22 + \$197 + \$160 = \3833.22 , the whole loss, which $\div \$38538$ (total value of the ship, cargo and $\frac{2}{3}$ of the freight) = $.099444\bar{4}$ = $9\frac{5}{6}$ per cent. of the whole loss; $\$6870 \times .099444\bar{4} = \683.331 , Goodrich & Co.'s loss, and $\$6870 - \$683.331 = \$6186.669$, what they realize for their flour; $\$10232 \times .099444\bar{4} = \1017.735 , ship's portion of the loss; $\$3200 \times .099444\bar{4} = \318.222 , freight's portion of the loss; $\$4000 \times .099444\bar{4} = \397.778 , M. H. New-

man & Co.'s loss; $\$5236 \times .09\frac{1}{2} = \$520.603+$, D. Appleton's loss; $\$9000 \times .09\frac{1}{2} = \$855+$, Hyde & Duren's loss, *Ans.*

Partnership.

¶ 172. EXAMPLES FOR PRACTICE.

2. A's loss will be $(\frac{1}{4})$ of $\$250 = \62.50 ; B's loss will be $(\frac{2}{5})$ of $\$250 = \100 ; and C's loss will be $(\frac{1}{5})$ of $\$250 = \50 , *Ans.*

3. The 1st person will have $\frac{1}{3}$ of $\$600 = \200 ; the 2d, $\frac{1}{3}$ of $\$600 = \200 ; and the 3d, $\frac{1}{3}$ of $\$600 = \200 , *Ans.*

4. A must lose $(\frac{2}{3})$ of 100 hhds. = 66.66 hhds., and B must lose $(\frac{1}{3})$ of 100 hhds. = 33.33 hhds., *Ans.*

5. Since $\$45$ is $\frac{3}{5}$ of the stock, $\frac{2}{5}$ of $\$45 = \18 is $\frac{2}{5}$ of it, which $\times 2 = \$36$, B's share of the stock, *Ans.*

6. A put in $\$1$ as often as B put in $\$2$; hence, the whole stock consisted of 3 parts, 1 of which was A's share, and 2 were B's; $\frac{1}{3}$ of $\$400 = \133.33 = A's stock, and $\frac{2}{3}$ of $\$400 = \266.66 = B's stock, *Ans.*

7. A's gain was $\frac{1}{4}$ of $\$164 = \41 ; B's was $\frac{3}{4}$ of $\$164 = \123 , and A received $\$123 - \$41 = \$82$ for his trouble, *Ans.*

8. $\$120$ (= 1 share) $\times .15 = \$18$, profit to 1 share; $\$18 \times 2 = \36 , to 2 shares; $\$18 \times 25 = \450 , to 25 shares, *Ans.*

9. $\$340 \div 100$ (no. of shares) = $\$3.40$, tax on 1 share; $\$3.40 \times 10 = \34 , tax on 10 shares, *Ans.*

10. A should pay $(\frac{2}{3})$ of $\$10 = \6.66 , and B should pay $(\frac{1}{3})$ of $\$10 = \3.33 , *Ans.*

¶ 173.

2. A, \$100 for 6 mo. = \$600 for 1 mo.	} \$1500	} = \$3260.
" \$150 " 6 " = \$900 " 1 "		
B, \$200 " 4 " = \$800 " 1 "		
" \$120 " 8 " = \$960 " 1 "		

Then, A would receive $(\frac{1}{3})$ of $\$95 = \31.66 , and B would receive $(\frac{2}{3})$ of $\$95 = \63.33 , *Ans.*

3. A, \$500 for 12 mo. = \$6000 for 1 mo.	} \$16800.
B, \$600 " 10 " = \$6000 " 1 "	
C, \$800 " 6 " = \$4800 " 1 "	

Then, A's share will be $(\frac{1}{3})$ of $\$700 = \233.33 ; B's $(\frac{1}{3})$ of $\$700 = \233.33 ; and C's $(\frac{1}{3})$ of $\$700 = \233.33 , *Ans.*

Banking.**¶ 174. EXAMPLES FOR PRACTICE.**

1. \$5, int. for 60 days, \$2.50, int. for 30 days, and \$.25, int. for 3 days of grace; $\$5 + \$2.50 + \$.25 = \7.75 , discount for 90 days and grace at 6 per cent., and $\$7.75 + (\frac{1}{4} \text{ of } \$7.75 =) \$1.29\frac{1}{4} = \9.0416 , discount at 7 per cent.; then, $\$500 - \$9.04\frac{1}{4} = \$490.95\frac{3}{4}$. *Ans.*

2. \$3, int. 60 d., \$1.50, int. 30 d., and \$.15, int. 3 d.; then, $\$3 + \$1.50 + \$.15 = \4.65 , discount at 6 per cent., and $\$4.65 - (\frac{1}{4} \text{ of } \$4.65 =) \$.775 = \3.875 . *Ans.*

3. \$.6, int. 60 d., \$.3, int. 30 d., and \$.30, int. 3 d.; then, $\$.90 + (\frac{1}{4} \text{ of } \$.90 =) \$.225 = \1.125 . *Ans.*

4. \$7.40, int. 60 d., \$3.70, int. 30 d., and \$.37, int. 3 d.; $\$7.40 + \$3.70 + \$.37 = \11.47 , discount, and $\$740 - \$11.47 = \$728.53$. *Ans.*

5. $\$1000 - \$15.50 = \$984.50$, the avails of the note; $\$984.50 \times .0155 = \$15.259\frac{1}{2}$, int. on the avails of the note for 3 mo. 3 d.; and $\$15.50 - \$15.259\frac{1}{2} = \$.24\frac{1}{2}$. *Ans.*

Taxes.

¶ 175. 3. $\$874 + \$210 = \$1084$, value of B's property; $\$30$ (tax on \$1000) + $\$2.40$ (tax on \$80) + $\$.12$ (tax on \$4) + (3 polls at \$.60 each) = $\$1.80 = \34.32 . *Ans.*

4. $\$.90$ (tax on \$3000) + $\$.12$ (tax on \$400) + $\$.24$ (tax on \$80) + $\$.06$ (tax on \$2) + $\$.120$ (poll tax) = $\$105.66$, C's tax; — $\$120$ (tax on \$4000) + $\$.18$ (tax on \$600) + $\$.210$ (tax on \$70) + $\$.15$ (tax on \$5) + $\$.60$ (poll tax) = $\$140.85$, D's tax. *Ans.*

Duties.**¶ 177. EXAMPLES FOR PRACTICE.**

2. 83 lbs. $\times 75 = 6225$ lbs. gross, which — 597 lbs. tare = 5628 lbs. net; then, $\$.04 \times 5628 = \225.12 . *Ans.*

3. 420 doz. = 5040, which — (5040 \times .10 =) 504 = 4536 bottles; then, $\$.05\frac{1}{2} \times 4536 = \249.48 . *Ans.*

4. 10 cwt. 2 qrs. $\times 6 = 84$ cwt. = 9408 lbs. gross, which — (14 lbs. $\times 84$) = 1176 lbs. tare = 8232 lbs. net; then, $\$.02\frac{1}{2} \times 8232 = \205.80 . *Ans.*

5. 171 lbs. + 125 lbs. + 109 lbs. + 99 lbs. = 504 lbs. gross, which — (4 lbs. draft + 64 lbs. tare =) 68 lbs. = 436 lbs. net; then, $\$.06\frac{1}{2} \times 436 = \28.34 . *Ans.*

¶ 178. EXAMPLES FOR PRACTICE.

2. $115 \text{ lbs.} \times 40 = 4600 \text{ lbs.}$; $\$11\frac{1}{2} \times 4600 = \$517\cdot50$, 18 per cent. of which $= \$93\cdot15$, *Ans.*

3. $33\frac{1}{2}$ per cent. $= \frac{1}{3}$ of the principal; hence, $\$256\cdot80 \div 3 = \$85\cdot60$, *Ans.*

4. $\$1\cdot92 \times 140 = \$268\cdot80$, which $\times 20 = \$53\cdot76$, duty on the whole; $\$53\cdot76 \div 140 = \384 , duty on 1 yard; $\$1\cdot92 + \$384 = \$2\cdot304$, which $\div (25 \text{ per cent., or } \frac{1}{4} \text{ of } \$2\cdot304 =) \$576 = \$2\cdot88$, *Ans.*

¶ 179. Review of Percentage.

EXERCISES.

1. $\$273\cdot51 \times \cdot07 = \$19\cdot1457$, int. for 1 yr., which $\div 36$ (10 d. $= \frac{1}{36}$ of 1 yr.) $= \$5318+$, int. for 10 d.; then, $\$19\cdot1457 + \$5318 = \$19\cdot677+$, *Ans.*

2. $\$496 \times \cdot08 = \$38\cdot88$, int. for 1 yr., which $\div 4 = \$9\cdot72$, int. for 3 mo., and $\frac{1}{8}$ of $\$9\cdot72 = \$2\cdot052$, int. for 19 d.; then, $\$38\cdot88 + \$9\cdot72 + \$2\cdot052 = \$50\cdot652$, *Ans.*

5. $\$2\cdot29 \times \cdot008\frac{1}{2} = \0189 , int. at 6 per cent., which $\div 2 = \$009+$, int. at 3 per cent., *Ans.*

6. $\$18 \times \cdot07 = \$1\cdot26$, int. for 1 yr., which $\times 2 = \$2\cdot52$, int. for 2 yrs.; $\$1\cdot26 \div 12 = \105 , int. for 1 mo., and $\frac{1}{12}$ of $\$105 = \049 , int. for 14 d.; then, $\$2\cdot52 + \$049 = \$2\cdot569$, *Ans.*

8. $\$20$, int. for 6 d., which $\div 6 = \$033\frac{1}{3}$, int. for 1 d., and $\$033\frac{1}{3} \times 5 = \$166+$, int. for 5 d., *Ans.*

9. $\$0005 \times \cdot06 = \003 , which $\times 567 = \$017+$, *Ans.*

10. $\$81 \times \$122\frac{1}{2} = \$9\cdot909$, int. at 6 per cent., which $\div 6 = \$1\cdot6515$, int. at 1 per cent.; $\$1\cdot6515 \times \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, 2, 3, 4\frac{1}{2}, 5, 6, 7, 7\frac{1}{2}, 8, 9, 10, 12$, and $12\frac{1}{2}$, respectively, will give the required results.

11. $\$09 \times 2\cdot736\frac{1}{2} = \$246+$, *Ans.*

12. Whole time 4 yrs. 25 d., which $- 1 \text{ yr.} = 3 \text{ yrs. } 25 \text{ d.}$; $\$175 \times \cdot07 = \$12\cdot25$, which $\times 3 = \$36\cdot75$, int. for 3 yrs.; $\$12\cdot25 \div 12 = \$1\cdot02\frac{1}{4}$, int. for 1 mo., which $\times \frac{1}{4} = \$65+$, int. for 25 d.; then, $\$175 + \$36\cdot75 + \$65 = \$212\cdot60$, *Ans.*

13. $\$56\cdot75 \times \cdot025\frac{1}{2}$ (5 mo. 3 d.) $= \$1\cdot447+$, which $\div \$56\cdot75 = \$58\cdot197+$, *Ans.*

14. Time to payment 2 yrs. 6 mo. 4 d.; $\$365\cdot37 \times \cdot05 = \$18\cdot2685$, which $\times 2 = \$36\cdot537$, int. for 2 yrs.; $\$18\cdot268 \div 2 = \$9\cdot134$, int. for 6 mo., which $\div 45 = \$203$, (nearly,) int. for 4 d.; $\$97\cdot16 - \$45\cdot874 = \$51\cdot286$; $\$365\cdot37 -$

$\$51.286 = \314.084 , new principal; remaining time 3 mo. 4 d.; $\$314.084 \times .05 = \15.7042 , which $\div 4 = \$3.92605$, int. for 3 mo., which $\times \frac{2}{5} = \$1.744+$, int. for 4 d.; then, $\$314.084 + \$3.926 + \$1.74 = \318.184 , *Ans.*

15. $\$203.17 - \$50 = \$153.17$; $\$153.17 \times .139\frac{1}{2}$ (2 yrs. 3 mo. 27 d.) $= \$21.367+$, which $+ \$153.17 = \$174.537+$, *Ans.*

16. Whole time 6 yrs. 10 mo. 6 d.; $\$870.05 \times .411 = \$357.59+$, which $+ \$870.05 = \$1227.64+$, and this sum $- \$186.06 = \$1041.58+$, *Ans.*

17. $\$208.04$ (1st payment) $- \$48.712$ (int. for 2 yrs. 2 mo. 8 d.) $= \$159.328$, and $\$317.92 - \$159.328 = \$158.592$, remainder for a new principal; $\$76$ (2d payment) $- \$5.458$ (int. 5 mo. 27 d.) $= \$70.542$, and $\$158.592 - \$70.542 = \$88.05$, remainder for a new principal, which $+ \$4.982$ (int. 9 mo. 21 d.) $= \$93.032$, *Ans.*

23. $\$422.40 \div \1.056 (am't of \$1, at the given rate and time) $= \$400$, *Ans.*

24. $\$426 \div \$1.20167 = \$354.507+$, *Ans.*

25. $\$300 \div \$1.045 = \$287.081+$, which $- \$250 = \$37.081+$, gain, *Ans.*

26. $\frac{1}{2}$ of $\$3120 = \1560 , which $\div \$1.015$ (3 mo.) $= \$1536.9454+$, and $\$1560 \div \1.03 (6 mo.) $= \$1514.563+$; then, $\$3120 - (\$1536.9454 + \$1514.563) = \$3051.5084 = \$68.491+$, *Ans.*

27. $\$49.875 \div \1.105 (int. on \$1) $= \$475$, *Ans.*

28. $\$35 \div \0.7 (int. on \$1, at 5 per cent.) $= \$500$, *Ans.*

29. $15.50 \div \$3.875$ (int. on \$500, 9 mo. 9 d., at 1 per cent.) $= .04 = 4$ per cent., *Ans.*

30. $\$20 - \$1.67 = \$18.33$; then, $\frac{33}{187} = .1766+$ $= 19.16\frac{2}{3}$ per cent., which is $\$19.76+$ on \$100, *Ans.*

31. $\$1.10 \times 37 = \40.70 , (cost,) which $- \$40 = \70 , (loss;) $\frac{70}{460} = .15217 = 15.217\%$ per cent. loss $= \$1.75$ on \$100, *Ans.*

32. $\$4.48 \times .125 = \56 , (gain,) which $+ \$4.48 = \60.48 , *Ans.*

33. $\$.92 \times 50 = \46 , (cost,) which $\times .10$ (10 per cent.) $= \$4.60$, (gain,) and this sum $+ \$46 = \50.60 ; then, $\$50.60 \div 40 = \1.265 per gal., *Ans.*

34. $\$950 + \$145 + \$25 = \1120 , (cost,) which $\times .20$ (per cent.) $= \$224$, (gain,) and $\$1120 + \$224 = \$1344$; then, $\$1344 \div 22400$ (lbs. = 10 tons,) $= \$0.06$ per lb., *Ans.*

35. First principal, on int. from Dec. 1st, 1841, \$2000		
Payment, June 1st, 1842,	\$163	
Int to time of 1st payment, (6 mo.,)	60	103
	—	—
Remainder for a new principal,		\$1897
Payment, Feb. 1st, 1843, less than int.		
then due,	\$12	
Payment, Jan. 1st, 1844,	300	
	—	
Amount exceeding int. due,	\$312	
Int. to time of 3d payment, (1 yr. 7 mo.,)	180·215	131·785
	—	—
Remainder for a new principal,		\$1765·215
Payment, Apr. 1st, 1845, less than int.		
then due,	\$20	
Payment, June 1st, 1845, less than int.		
then due,	20	
Payment, Aug. 1st, 1845,	400	
	—	
Amount exceeding int. due,	\$440	
Int. to time of 6th payment, (1 yr. 7 mo.,)	167·695	272·305
	—	—
Remainder for a new principal,		\$1492·91
Payment, Jan. 1st, 1846,	\$100	
Int to time of 7th payment, (5 mo.,)	37·322	62·678
	—	—
Remainder for a new principal,		\$1430·232
Payment, Aug. 1st, 1847,	\$150	
Int. to time of 8th payment, (1 yr.		
7 mo.,)	135·872	14·128
	—	—
Remainder for a new principal,		\$1416·104
Payment, Oct. 1st, 1847,	\$75	
Int. to time of 9th payment, (2 mo.,)	14·161	60·839
	—	—
Remainder for a new principal,		\$1355·265
Int. to Dec. 1st, 1847, (2 mo.,)		13·552
		—
Balance due Dec. 1st, 1847, by U. S. rules,	\$1368·817	+

2D. BY THE CONNECTICUT RULE.

First principal, on int. from Dec. 1st, 1841,		\$2000
Payment, June 1st, 1842,	\$163	
Int on payment, (6 mo.,)	4·89	
	—	
Amount of 1st payment,	\$167·89	

<i>Amount brought forward,</i>	\$167·89	\$2000
Int. on prin. to Dec. 1st, 1842, (1 yr.)	120	47·89
	<hr/>	<hr/>
Remainder for a new principal,		\$1952·11
Payment, Feb. 1st, 1843, less than int. then due,	\$12	
Payment, Jan. 1st, 1844,	300	
	<hr/>	
Amount exceeding int. due,	\$312	
Int. on prin. to Jan. 1st, 1844, (1 yr. 1 mo.,)	126·887	185·113
	<hr/>	<hr/>
Remainder for a new principal,		\$1766·997
Payment, Apr. 1st, 1845, less than int. then due,	\$20	
Payment, June 1st, 1845, less than int. then due,	20	
Payment, Aug. 1st, 1845,	400	
	<hr/>	
Amount exceeding int. due,	\$440	
Int. on prin. to Aug. 1st, 1845, (1 yr. 7 mo.,)	167·864	272·136
	<hr/>	<hr/>
Remainder for a new principal,		\$1494·861
Payment, Jan. 1st, 1846,	\$100	
Int on payment, (7 mo.,)	3·50	
	<hr/>	
Amount of 7th payment,	\$10·350	
Int. on prin. to Aug. 1st, 1846, (1 yr.,)	89·691	13·809
	<hr/>	<hr/>
Remainder for a new principal,		\$1481·052
Payment, Aug. 1st, 1847,	\$150	
Int. on prin. to time of 8th payment, (1 year,)	88·863	61·137
	<hr/>	<hr/>
Remainder for a new principal,		\$1419·915
Payment, Oct. 1st., 1847,	\$75	
Int. on payment, (2 mo.,)	·75	
	<hr/>	
Amount of 9th payment,	\$75·75	
Int. on prin. to Dec. 1st, 1847, (4 mo.,)	28·398	47·352
	<hr/>	<hr/>
Balance due Dec. 1st, 1847,		\$1372·563+.

3D. BY THE VERMONT RULE.

Amount of \$2000 for 6 yrs.,	\$2720
" " \$163 for 5 yrs. 6 mo.,	\$216.79
" " \$12 " 4 " 10 "	\$15.48
" " \$300 " 3 " 11 "	\$370.50
" " \$20 " 2 " 8 "	\$23.20
" " \$20 " 2 " 6 "	\$23
" " \$400 " 2 " 4 "	\$456
" " \$100 " 1 yr. 11 "	\$111.50
" " \$150 " 4 "	\$153
" " \$75 " 2 "	\$75.75
	<u>\$1445.22</u>
Balance due Dec. 1st, 1847,	\$1274.78

EQUATION OF PAYMENTS.

¶ 181. EXAMPLES FOR PRACTICE.

4. \$200 for 5 mo. is the same as \$1000 for 1 mo.

\$325.50 " 3 " " " " \$976.50 " 1 "

\$413.37 " 2 " " " " \$526.74 " 1 "

Then, $\$2803.24 \div \$938.87 = 2.985+$ months = 2 months and 29+ days, *Ans.*

5. $\$309.50 \times 8 + \$161 \times 5\frac{1}{2} + \$33.25 \times 10\frac{1}{2} = \$4033.291+$, which $\div \$533.75 = 7.556+$ mo. = 7 mo. 16+d., mean time; then, $\$533.75 \div \$1.037\frac{3}{4}$ (am't of \$1, for 7 mo. 16 d., at 6 per cent.) = $\$514.375+$, *Ans.*

6. $\$50 \times 2 + \$100 \times 5 + \$150 \times 8 = \1800 , which $\div \$300 = 6$ months, *Ans.*

7. $\$136 \times 10 + \$96 \times 7 + \$260 \times 4 = \3072 , which $\div \$492 = 6$ mo. 7+ d., *Ans.*

8. $\$200 \times 4 + \$200 \times 8 = \$2400$, which $\div \$600 = 4$ mo., *Ans.*

9. $\$100 \times 3 + \$75 \times 4 + \$125 \times 6 = \1350 , which $\div \$300 = 4\frac{1}{2}$ mo., *Ans.*

PROPORTION.

¶ 191. EXAMPLES FOR PRACTICE.

2. $\overset{2}{20}$ horses : $\overset{3}{6} :: \overset{7}{70}$ bushels : —
 $7 \times 3 = 21$ bushels, *Ans.*
5. $(13^\circ 10' 35'' =) 47435'' : (360^\circ =) 1296000'' :: 1$
 day : —
 $1 \times 1296000 = 1296000$, which $\div 47435 = 27$ days 7 h.
 43 m. 6 s. +, *Ans.*
6. $\$145 : \$378 :: \$12\cdot63$, taxes : $\$32\cdot925+$, *Ans.*
7. $\$75 : \$6 :: 7$ lbs. : 56 lbs., *Ans.*
8. $\$100 : \$357\cdot82 :: \$6 : \$21\cdot469+$, *Ans.*
9. 6 ft. : 153 ft. :: (5 ft. 8 in. =) 68 in. : (1734 in. =)
 $144\frac{1}{2}$ ft., *Ans.*
10. $\overset{3}{10}$ persons : $\overset{3}{30}$ persons :: 3 bu. : 9 bu., *Ans.*
11. $\overset{4}{3}$ mo. : $\overset{4}{8}$ mo. :: 120 men : 480 men, *Ans.*
12. $\overset{4}{24}$ m. : (10 h. =) $\overset{100}{600}$ m. : 1 pipe : 25 pipes, *Ans.*
13. $\overset{4}{1600}$ men : $\overset{3}{1200}$ men : 9 mo. : $6\frac{3}{4}$ mo., *Ans.*
14. $\overset{5}{25}$ rds. long : $\overset{8}{40}$ rds. long :: 4 rds. wide : $6\frac{2}{3}$ rds.
 wide, *Ans.*
15. $\overset{2}{10}$ h. : $\overset{6}{12}$ h. :: $\overset{3}{15}$ d. : 18d., *Ans.*
16. $\overset{7}{21}$ cows : $\overset{2}{6}$ cows :: $\overset{13}{91}$ days : 26 days, *Ans.*
17. $\$806 : \$292 :: 6$ mo. : 2 mo. 5 + d., *Ans.*
18. 7 lb. : 12 lb. :: $\$ \frac{7}{12}$: —
 $\$ \frac{7}{12} \times 12 = \7 , which $\div 7 = 1$, *Ans.*
19. $(6\frac{1}{2} =) \frac{13}{2}$ yd. : $(9\frac{1}{2} =) \frac{19}{2}$ yd. :: 33 : —
 $\$3 \times \frac{13}{2} = \$19\frac{1}{2}$, which $\div \frac{13}{2}$ ($\frac{2}{13}$ of $1\frac{1}{2}$) = $\$22\frac{2}{3} = \$24\cdot269+$,
Ans.
20. 2 oz. : '75 oz. :: $\$2\cdot24$: —
 $\$2\cdot24 \times '75 = \$1\cdot6800$, which $\div 2 = \$84$, *Ans.*
21. $\frac{4}{7}$ oz. : 1 oz. :: $\$ \frac{4}{7}$: —
 $\$ \frac{4}{7} \times 1 = \$ \frac{4}{7}$, which $\div \frac{4}{7}$ ($\frac{7}{4}$ of $1\frac{1}{4}$) = $\$1\cdot283+$,
Ans.
22. $\frac{3}{4}$ yd. : $(40\frac{1}{2} =) \frac{81}{2}$ yd. :: $\$ \frac{3}{4}$: —
 $\$ \frac{3}{4} \times \frac{81}{2} = \$121\frac{3}{8}$, which $\div \frac{3}{4}$ ($\frac{4}{3}$ of $1\frac{1}{3}$) = $\$22\frac{2}{3} = \$24\cdot269+$,
Ans.

23. ($\frac{2}{3}$ of $\frac{1}{5}$ =) $\frac{2}{15}$ ves. : 1 ves. :: \$957 : —
 $\$957 \times 1 = \957 , which $\div \frac{2}{15} = \$1794.375$, *Ans.*
 24. (12 A. 3 R. =) 2040 P. : (35 A. 1 R. 20 P. =) 5660 P. :: (78 qrs. 3 pks. =) 2499 pks. : 6933 $\frac{1}{2}$ pks. = 216 qrs. 5 bu. 1 pk. 4 qts., *Ans.*

NOTE. By cancelation the proportion may become, 34 P. : 283 P. :: 833 pks. : —

25. $\frac{1}{3} + \frac{1}{6} + \frac{1}{12} + \frac{1}{24} = \frac{1}{2}$ of the cistern in 1 minute; then,
 $\frac{1}{2}$ eightieths : $\frac{1}{80}$ eightieths :: 1 minute : 5 $\frac{1}{2}$ minutes, *Ans.*
 26. \$ bar. : 17\$ bar. :: \$33 : \$979, *Ans.*
 27. 2\$ lbs. : 185 lbs. :: \$75 : \$55.50, *Ans.*
 28. 1 hhd. : 15 hhd. :: \$2.39 : \$35.85, *Ans.*
 29. 15 hhd. : 1 hhd. :: \$35.85 : \$2.39, *Ans.*
 30. \$972 : \$11 $\frac{1}{2}$:: \$607.50 : \$7.083 $\frac{1}{2}$, *Ans.*
 31. \$1.24 : \$93 :: 12 oz. : 9 oz., *Ans.*
 32. 6 oz. $\times 16 = 96$ oz. = 6 lbs., their daily allowance;
 224 lbs. $\div 28 = 8$ lbs., to be added to their daily allowance;
 then, 6 lbs. : 14 lbs. :: 6 oz. : 14 oz., *Ans.*

Compound Proportion.

¶ 193. EXAMPLES FOR PRACTICE.

1. 16 days, being of the same kind as the answer required, must be made the 3d term; then,

Inverse, $\frac{2}{4}$ men	$\frac{2}{4}$ $\frac{4}{2}$: 6 men	}	:: 16 days : —
Direct, 20 ft. long	$\frac{5}{10}$ $\frac{10}{5}$: 20 ft. long		
Direct, 6 ft. high	$\frac{3}{3}$ $\frac{3}{3}$: 3 ft. high		
Direct, 4 ft. thick	$\frac{6}{6}$ $\frac{6}{6}$: 6 ft. thick		

Reducing the compound ratio to a simple one, shortening the process by cancelation, we have the simple proportion —
 1 : 5 :: 16 days : 80 days, *Ans.*

2. 1200 lbs. $\times 9 = 10800$ lbs., the weight of the hogs-heads; and 250 lbs. $\times 50 = 12500$ lbs., the weight of the tierces; then,

$\begin{array}{l} \text{Direct, } 27 \\ 100 \text{ lbs. : } 125 \text{ lbs.} \end{array} \left. \begin{array}{l} 5 \\ 4 \end{array} \right\} :: \$16 : \text{---}$
 $\text{Direct, } 20 \text{ mi. : } 100 \text{ mi.}$
 and $\$4 \times 5 \times 125 = \2500 , which $\div 27 = \$92.592+$,
Ans.

$\begin{array}{l} 3. \text{ Direct, } 7 \text{ men : } 21 \text{ men} \\ \text{Direct, } 14 \text{ days : } 3 \text{ days} \end{array} \left. \begin{array}{l} 3 \\ 4 \end{array} \right\} :: 56 \text{ lbs. : ---}$
 and $4 \text{ lbs.} \times 3 \times 3 = 36 \text{ lbs.}$, *Ans.*

$\begin{array}{l} \$92 \\ \$3.68 \\ \$6.44 \end{array} \left. \begin{array}{l} 3 \\ 4 \end{array} \right\} :: 4 \text{ men : ---}$
 $\text{Inverse, } 16 \text{ d. : } 3 \text{ d.}$
 and $1 \text{ man} \times 6.44$ and the product $\div .92 = 7 \text{ men}$, *Ans.*

$\begin{array}{l} 5. \text{ Direct, } \$06 : \$18 \\ \text{Inverse, } \$90 : \$76 \end{array} \left. \begin{array}{l} 3 \\ 4 \end{array} \right\} :: (7 \text{ oz. } 8 \text{ drs.}) : 120 \text{ drs. : ---}$
 and $4 \text{ drs.} \times 76 = 304 \text{ drs.} = 1 \text{ lb. } 3 \text{ oz.}$, *Ans.*

$\begin{array}{l} 6. \text{ Direct, Prin. } \$100 : \$400 \\ \text{Direct, Time, } 12 \text{ mo. : } 9 \text{ mo.} \end{array} \left. \begin{array}{l} 3 \\ 3 \end{array} \right\} :: \$6 \text{ int. : } \$18 \text{ int., } \text{Ans.}$

$\begin{array}{l} 7. \text{ Inverse, Prin. } \$400 : \$100 \\ \text{Direct, Int. } \$6 : \$18 \end{array} \left. \begin{array}{l} 3 \\ 3 \end{array} \right\} :: 12 \text{ mo. : } 9 \text{ mo., } \text{Ans.}$

$\begin{array}{l} 8. \text{ Direct, Prin. } \$300 : \$100 \\ \text{Direct, Time, } 9 \text{ mo. : } 12 \text{ mo.} \end{array} \left. \begin{array}{l} 2 \\ 3 \end{array} \right\} :: \$18 \text{ int. : } \$6 \text{ int., } \text{Ans.}$

$\begin{array}{l} 9. \text{ Inverse, Time, } 9 \text{ mo. : } 12 \text{ mo.} \\ \text{Direct, Int. } \$6 : \$18 \end{array} \left. \begin{array}{l} 3 \\ 4 \end{array} \right\} :: \$100 \text{ prin. : } \$400 \text{ prin., } \text{Ans.}$

$\begin{array}{l} 10. \text{ Direct, Prin. } \$15 : \$100 \\ \text{Direct, Time, } 2 \text{ mo. : } 4 \text{ mo.} \end{array} \left. \begin{array}{l} 3 \\ 2 \end{array} \right\} :: \$4 \text{ int. : } \$8 \text{ int.} = 8 \text{ per cent., } \text{Ans.}$

¶ 194. Review of Proportion.

EXERCISES.

1. $76 \text{ yds.} \times 4 = 304 \text{ qrs.}$, which $\div 5 = 60.8 \text{ E. E.}$; then,
 $60.8 \text{ E. E.} : 1 \text{ E. E.} :: \$113.17 : \$1.861+$, *Ans.*

2. $24 \text{ E. E.} \times 4 = 96 \text{ E. E.} = 120 \text{ yds.}$; then,

- 6
120 yds. : 1 yd. :: $\frac{4}{1.9}$: \$80, *Ans.*
3. Inverse, $\frac{9}{15}$ mo. : 8 mo. :: 15 oz. : $12\frac{2}{3}$ oz., *Ans.*
4. $\frac{2.5}{15}$: $\frac{3.75}{57}$:: 360 acres : 540 acres, *Ans.*
5. Inverse, $\frac{208}{52}$ d. : $\frac{228}{57}$ d. :: 185 qrs. : $202\frac{1}{2}$ qrs., *Ans.*
6. ($\frac{2}{5}$ of $\frac{3}{5}$ =) $\frac{2}{7}$ mine : 1 mine :: 171£. : 330£., *Ans.*
7. $\frac{5}{9}$ T. $\frac{4}{1} \times \frac{63}{1} = 140$ gal.; then, $\frac{1}{3}$ gal. : 140 gal. :: $\frac{63}{1}$: \$140, *Ans.*; or, the first and third terms being the same number, they may be dropped, and the second term taken to express the answer, thus, \$140, as before.
8. 1 cwt. = 112 lbs., $3\frac{1}{2}$ lbs. = $\frac{19}{2}$ lb., and $1\frac{1}{2}$ £. = $\frac{3}{2}$ £.; then, 112 lbs. : $\frac{19}{2}$ lb. :: $\frac{3}{2}$ £. : $1\frac{1}{2}$ £. = 10½ d., *Ans.*
9. $\frac{20}{5}$ mi. : $\frac{36}{9}$ mi. :: ($4\frac{1}{2}$ cwt. =) 504 lbs. : $907\frac{1}{2}$ lbs., *Ans.*
10. 24 h. : 1 h. :: 360° : 15°, *Ans.*; 60 m. : 1 m. :: 15° : 4', *Ans.*; 60 s. : 1 s. :: 4' : 15'', *Ans.*
11. Direct, 9 persons : 14 persons }
Direct, 5 mo. : 8 mo. } :: $\frac{10}{50}$: \$450 : \$1120, *Ans.*

ALLIGATION — Medial.

¶ 195. EXAMPLES FOR PRACTICE.

2. 5 lbs. at 10 cts. cost 50 cts.
8 " " 12 " " 96 "
20 " " 14 " " 280 " $4\frac{2}{3} = 12\frac{1}{3}$ cts., *Ans.*
- 33 lbs. 426 cts.
3. 3 oz. 20 carats = 60 carats.
5 " 22 " = 110 " $1\frac{1}{8} = 21\frac{1}{8}$ carats, *Ans.*
- 8 oz. 170 carats.
4. 40 gals. at 42 cts. cost 1680 cts.
6 " " 0 " " 0 " $1\frac{1}{8} = 36\frac{1}{8}$ cts., *Ans.*
- 46 gals. 1680 cts.

5. 5 h. at $64^\circ = 320^\circ$
 4 h. " $70^\circ = 280^\circ$
 2 h. " $75^\circ = 150^\circ$
 3 h. " $73^\circ = 219^\circ$

$$\frac{222}{14} = 69\frac{3}{14} \text{ deg., Ans.}$$

14 h. 969°

6. 16 A. at \$90, cost \$1440
 22 " " \$75 " \$1650
 18 " " \$64 " \$1152
 10 " " \$55 " \$ 550
 30 " " \$36 " \$1080
 42 " " \$25 " \$1050

$$\frac{\$2222}{13\frac{1}{2}} = \$50.159+, \text{ Ans.}$$

138 A. \$6922

7. 3 cows at \$35 cost \$105
 4 " " \$30 " \$120
 6 " " \$24 " \$144
 4 " " \$20 " \$ 80
 2 " " \$18 " \$ 36
 1 " " \$13 " \$ 13

$$\frac{\$422}{20} = \$24.90, \text{ Ans.}$$

20 cows. \$498

Alligation Alternate.

¶ 197. EXAMPLES FOR PRACTICE.

1. 12 cts. $\left\{ \begin{array}{l} 8 \text{ cts.} \text{---} \\ 10 \text{ cts.} \text{---} \\ 14 \text{ cts.} \text{---} \end{array} \right. \begin{array}{l} 2 \text{ lbs.} = 2 \text{ lbs. of the 1st kind.} \\ 2 \text{ lbs.} = 2 \text{ lbs. " " 2d kind.} \\ 4 \text{ lbs.} + 2 \text{ lbs.} = 6 \text{ lbs. 3d kind.} \end{array}$
2. 10 cts. $\left\{ \begin{array}{l} 7 \text{ cts.} \text{---} \\ 9 \text{ cts.} \text{---} \\ 12 \text{ cts.} \text{---} \end{array} \right. \begin{array}{l} 2 \text{ lbs.} = 2 \text{ lbs. of the 1st kind.} \\ 2 \text{ lbs.} = 2 \text{ lbs. " " 2d kind.} \\ 3 \text{ lbs.} + 1 \text{ lb.} = 4 \text{ lbs. 3d kind.} \end{array}$
3. The proportions of the 1st and 2d kinds are alike. To find what will be the proportion of the 3d kind, using
 1 lb. of 1st kind, 2 lbs. : 1 lb. :: 4 lbs. : 2 lbs. of 3d kind
 4 lbs. " " 2 lbs. : 4 lbs. :: 4 lbs. : 8 lbs. " " "
 6 lbs. " " 2 lbs. : 6 lbs. :: 4 lbs. : 12 lbs. " " "
 10 lbs. " " 2 lbs. : 10 lbs. :: 4 lbs. : 20 lbs. " " "
 20 lbs. " " 2 lbs. : 20 lbs. :: 4 lbs. : 40 lbs. " " "
4. 24d. $\left\{ \begin{array}{l} 16d. \text{---} \\ 20d. \text{---} \\ 32d. \text{---} \end{array} \right. \begin{array}{l} 8 \text{ lbs.} = 8 \text{ lbs.} \\ 8 \text{ lbs.} = 8 \text{ lbs.} \\ 8 \text{ lbs.} + 4 \text{ lbs.} = 12 \text{ lbs.} \end{array} \left. \begin{array}{l} \\ \\ \end{array} \right\} \begin{array}{l} \text{Proportions} \\ \text{alike.} \end{array}$
- 8 lbs. : 5 lbs. :: 12 lbs. : $7\frac{1}{2}$ lbs. of the 3d kind, to be taken
 with 5 lbs. of the 1st and 2d kinds.

5. 70 cts. $\left\{ \begin{array}{l} 0 \text{ — } 10 \text{ gal., proportional quantity of water.} \\ 80 \text{ — } 70 \text{ gal., proportional quantity of rum.} \end{array} \right.$
 70 gal. rum : 60 gal. rum :: 10 gal. water : 84 gal. water.

Ans.

6. 84 cts. $\left\{ \begin{array}{l} \$1.50 \text{ — } 34 \text{ bu. proportional quant. wheat.} \\ \$1.16 \text{ — } 9 \text{ bu. " " rye.} \\ \$.75 \text{ — } 32 \text{ bu. " " corn.} \\ \$.50 \text{ — } 66 \text{ bu. " " barley.} \end{array} \right.$

34 bu. wheat : 4 bu. wheat :: 9 bu. rye : 1 $\frac{1}{7}$ bu. rye,
 34 " " : 4 " " :: 32 " corn : 3 $\frac{1}{3}$ " corn, } Ans.
 34 " " : 4 " " :: 66 " bar. : 7 $\frac{1}{3}$ " barley, }

7. 22 $\left\{ \begin{array}{l} 17 \text{ — } 2 = 2 \text{ parts of the 1st kind,} \\ 19 \text{ — } 2 = 2 \text{ parts of the 2d kind,} \\ 21 \text{ — } 2 = 2 \text{ parts of the 3d kind,} \\ 24 \text{ — } 5+3+1=9 \text{ parts of the 4th kind,} \end{array} \right.$ } Ans.

8. The proportions of the first 3 kinds are alike. 2 oz. : 1 oz. :: 9 oz. : 4 $\frac{1}{2}$ oz., (of the 4th kind,) which + 1 + 1 + 1 = 7 $\frac{1}{2}$ oz. of the mixture, Ans.

9. 7 $\frac{1}{2}$ oz. (compound in the last ex.) = 1 $\frac{1}{2}$ oz.

15 oz. $\left\{ \begin{array}{l} 1 \frac{1}{2} \text{ oz. : 15 oz. :: 1 oz. : 2 oz. of 1st 3 kinds,} \\ \text{mixture. } 1 \frac{1}{2} \text{ oz. : 15 oz. :: (4 \frac{1}{2}) = \frac{3}{2} \text{ oz. : 9 oz. 4th kind,} \\ 30 \text{ oz. } 1 \frac{1}{2} \text{ oz. : 30 oz. :: 1 oz. : 4 oz. 1st 3 kinds,} \\ \text{mixture. } 1 \frac{1}{2} \text{ oz. : 30 oz. :: 4 \frac{1}{2} \text{ oz. : 18 oz. 4th kind,} \end{array} \right.$ } Ans.

10. 12 cts. $\left\{ \begin{array}{l} 8 \text{ cts. — } 2 \text{ lbs. prop. quan. 1st. kind,} \\ 10 \text{ cts. — } 2 \text{ lbs. " " 2d. " } \\ 14 \text{ cts. — } 4 \text{ lbs. + 2 lbs. = 6 lbs. " " 3d. " } \end{array} \right.$

2 lbs. + 2 lbs. + 6 lbs. = 10 lbs., amount of the proportional quantities. The proportions of the 1st and 2d kinds are alike; then,

10 lbs. : 100 lbs. :: 2 lbs. : 20 lbs., of 1st and 2d kinds, } Ans.
 10 lbs. : 100 lbs. :: 6 lbs. : 60 lbs., of 3d kind, }

11. 8d. $\left\{ \begin{array}{l} 4d. \text{ — } 3 \\ 6d. \text{ — } 1 \\ 9d. \text{ — } 2 \\ 11d. \text{ — } 4 \end{array} \right.$ } 10, sum of the proportional quantities.

As $\left\{ \begin{array}{l} 10 : 240 :: 3 \text{ lbs. : 72 lbs. at 4d.} \\ 10 : 240 :: 1 \text{ lb. : 24 lbs. at 6d.} \\ 10 : 240 :: 2 \text{ lbs. : 48 lbs. at 9d.} \\ 10 : 240 :: 4 \text{ lbs. : 96 lbs. at 11d.} \end{array} \right.$ } Ans.

EXCHANGE.**¶ 200. Exchange with England.**

1. $\$4\cdot44\frac{1}{2} \times 5000 = \$22222\cdot22\frac{1}{2}$, (the nominal value of 5000£. sterling,) which $+ (9\frac{1}{2}$ per cent. of the nominal value $=) \$2111\cdot1109\frac{1}{2} = \$24333\cdot333+$, *Ans.*

2. $\$4\cdot44\frac{1}{2} \times 7000 = \$31111\cdot11\frac{1}{2}$, (the nominal value;) he sold the bill for $(11 - 9\frac{1}{2}) = 1\frac{1}{2}$ per cent. of its nominal value more than its par value; $\$31111\cdot11\frac{1}{2} \times \cdot 015 = \$466\cdot66\frac{1}{2}$, *Ans.*

3. $\$4\cdot44\frac{1}{2} \times 4000 = \$17777\cdot77\frac{1}{2}$, (nominal value,) which $+ \$1688\cdot8881\frac{1}{2}$ ($9\frac{1}{2}$ per cent. of itself) $= \$19466\cdot6659\frac{1}{2}$, (par value;) and $\$19466\cdot6659\frac{1}{2} - \$389\cdot333319\frac{1}{2}$ ($= 2$ per cent. of par value, expense of transportation) $= \$19077\cdot3326+$, what he would have realized for the bill, had he imported the specie; $\$17777\cdot77\frac{1}{2}$ (nominal value) $+ \$1422\cdot22\frac{1}{2}$ ($= 8$ per cent. of the nominal value) $= \$19200$, avails of the bill; then, $\$19200 - \$19077\cdot3326 = \$122\cdot667+$, amount saved, *Ans.*

4. $\$4\cdot44\frac{1}{2} \times 2000 = 8888\cdot88\frac{1}{2}$, (nominal value,) which $+ \$844\cdot44\frac{1}{2}$ ($9\frac{1}{2}$ per cent. of nominal value) $= \$9733\cdot33\frac{1}{2}$, real value, $\frac{1}{10}$ per cent of which $= \$9\cdot73\frac{1}{2}$, commission on the real value of the bill; $\$8833\cdot88\frac{1}{2} + \$888\cdot88\frac{1}{2}$ (10 per cent. of nominal value) $= \$9777\cdot77\frac{1}{2}$, avails of the bill, which $- \$9733\cdot33\frac{1}{2}$ (real value) $= \$44\cdot44\frac{1}{2}$, which $\times \cdot 05 = \$2\cdot22\frac{1}{2}$, commission on $\$44\cdot44\frac{1}{2}$; then, $\$9\cdot73\frac{1}{2} + \$2\cdot22\frac{1}{2} = \$11\cdot95\frac{1}{2}$, *Ans.*

¶ 201. Exchange with France.

1. $\$.186 (= 1 \text{ franc}) \times 5\cdot4 = \$1\cdot0044$, the amount received on each dollar; $\$.0044$ (gain on \$1) $\times 2500 (= \text{number of dollars}) = \11 , *Ans.*

2. $\$.186 (= 1 \text{ franc}) \times 5\cdot31 = \$.98766$, amount received on \$1, and $\$1 - \$.98766 = \$.01234$, loss on \$1; then, $\$.01234 \times 2800 (= \text{number of dollars}) = \$34\cdot552$, less than the value of the bill, *Ans.*

DUODECIMALS.**Multiplication of Duodecimals.****¶ 204. EXAMPLES FOR PRACTICE.**

3. 12 ft. 8' \times 1 ft. 1' $=$ 13 ft. 8' 8'', which $\times 15 = 205$ ft. 10', *Ans.*

4.

371 ft. 2' 6" " "

181 1 9

6"	×	9"	=				4	6
2'	×	9"	=				1	6
371 ft.	×	9"	=	23	2	3		
6"	×	1'	=					6
2'	×	1'	=				2	
371 ft.	×	1'	=	30	11			
6"	×	181 ft.	=	7	6	6		
2'	×	181 ft.	=	30	2			
371 ft.	×	181 ft.	=	67151				

67242 10 1 4 6, Ans.

5. 47 ft. 3' \times 7 ft. 6' = 39 sq. yds. 3 sq. ft. 4' 6".

6. $26 \text{ ft. } 8' \times 24 \text{ ft. } 9' = 660 \text{ sq. ft.} = 73\frac{1}{3} \text{ sq. yds.}$; then,
 $\$90 \times 73\frac{1}{3} = \$66, \text{ Ans.}$

7. $15\text{ ft. }4' \times 16\text{ ft.} \times 2 = 490\text{ ft. }8\text{ in.}$, $10\text{ ft. }6' \times 24\text{ ft.} = 252\text{ ft.}$, $11\text{ ft. }4' \times 8\text{ ft.} \times 3 = 272\text{ ft.}$, $9\text{ ft. }6' \times 7\text{ ft.} = 66\text{ ft.}$, $6', 14\text{ ft. }2' \times 18 = 255\text{ ft.}$, $20\text{ ft. }8' \times 16 \times 2 = 661\text{ ft. }4'$, which amounts added together $= 1997\text{ ft. }6'$; then, $\$02 \times 1997 = \39.95 , *Ans.*

8. 32 ft. 6' + 32 ft. 6' (side walls) + 21 ft. 6' + 21 ft. 6' (end walls, deducting the corners) = 108 ft., (length of the walls,) which $\times 7$ ft. (height) = 756 sq. ft.; then, $756 \text{ sq. ft.} \div 16\frac{1}{2} = 45\frac{9}{11}$ perches of stone in the walls. 32 ft. 6' + 24 ft. 6' + 24 ft. 6' = 114 ft., (girt of the walls,) which $\times 7 = 798$ sq. ft.; then, $798 \text{ sq. ft.} \div 16\frac{1}{2} = 48\frac{4}{11}$ perches, the mason must be paid for. *Ans.*

9. $7 \text{ ft.} \times 3 \text{ ft.} \times 3 \text{ ft.} 4' = 70 \text{ cu. ft., which } \div 16 = 4\frac{1}{2}$
C. ft.; $\$40 \times 4\frac{1}{2} = \175 , Ans.

10. \$1.92 a cord is \$24 a cord foot; 10 ft. \times 3 ft. 9' \times 4 8' = 175 cu. ft. = 1 C. 2 $\frac{1}{2}$ C. ft.; \$24 \times 2 $\frac{1}{2}$ = \$70 $\frac{1}{2}$, cost of 2 $\frac{1}{2}$ C. ft., which + \$1.92 (cost of 1 cord) = \$2.62 $\frac{1}{2}$,
Ans.

¶ 205. 1. $4\frac{1}{2}$ ft. \times $2\frac{1}{2}$ ft. = 117 cu. ft.; $\$75 \times 117$
= \$8775, *Ans.*

2. $7'5 \text{ ft.} \times 3'6 \text{ ft.} \times 4'8 \text{ ft.} = 129'6 \text{ cu. ft.} = 1 \text{ C. } 1\frac{6}{10} \text{ cu. ft., Ans.}$

3. $10 \text{ ft.} \times 3\frac{1}{2} \text{ ft.} \times 3\frac{1}{2} \text{ ft.} = 119 \text{ cu. ft.} = 7\frac{7}{16} \text{ C. ft.}$
Ans.

EXTRACTION OF THE SQUARE ROOT.

T 209. EXAMPLES FOR PRACTICE.

$$\begin{array}{r} 43264 \text{ (208, Ans.} \\ 4 \end{array}$$

$$\begin{array}{r} 408 \text{) } 3264 \\ \underline{3264} \end{array}$$

$$4. \quad \begin{array}{r} 998001 \text{ (999, Ans.} \\ \underline{81} \end{array}$$

$$\begin{array}{r} 189 \text{) } 1880 \\ \underline{1701} \end{array}$$

$$\begin{array}{r} 1989 \text{) } 17901 \\ \underline{17901} \end{array}$$

$$5. \quad \begin{array}{r} 23409 \text{ (153, Ans.} \\ \underline{1} \end{array}$$

$$\begin{array}{r} 25 \text{) } 134 \\ \underline{125} \end{array}$$

$$\begin{array}{r} 303 \text{) } 909 \\ \underline{909} \end{array}$$

$$6. \quad \begin{array}{r} 9645192360241 \text{ (3105671, Ans.} \\ \underline{9} \end{array}$$

$$\begin{array}{r} 61 \text{) } 64 \\ \underline{61} \end{array}$$

$$\begin{array}{r} 6205 \text{) } 35192 \\ \underline{31025} \end{array}$$

$$\begin{array}{r} 62106 \text{) } 416736 \\ \underline{372636} \end{array}$$

$$\begin{array}{r} 621127 \text{) } 4410002 \\ \underline{4347889} \end{array}$$

$$\begin{array}{r} 6211341 \text{) } 6211341 \\ \underline{6211341} \end{array}$$

$$9. \quad \begin{array}{r} 36372961 \text{ (6031, Ans.} \\ \underline{36} \end{array}$$

$$\begin{array}{r} 1203 \text{) } 3729 \\ \underline{3609} \end{array}$$

$$\begin{array}{r} 12061 \text{) } 12061 \\ \underline{12061} \end{array}$$

$$7. \quad \begin{array}{r} 001296 \text{ (036, Ans.} \\ \underline{9} \end{array}$$

$$\begin{array}{r} 66 \text{) } 396 \\ \underline{396} \end{array}$$

$$8. \quad \begin{array}{r} 2916 \text{ (54, Ans.} \\ \underline{25} \end{array}$$

$$\begin{array}{r} 104 \text{) } 416 \\ \underline{416} \end{array}$$

$$10. \quad \begin{array}{r} 164 \text{ (128, Ans.} \\ \underline{1} \end{array}$$

$$\begin{array}{r} 22 \text{) } 064 \\ \underline{44} \end{array}$$

$$\begin{array}{r} 248 \text{) } 2000 \\ \underline{1984} \\ 16 \end{array}$$

11. $\dot{3}(1\dot{7}3+, Ans.$

$$\begin{array}{r} 1 \\ 27 \overline{) 200} \\ \underline{189} \\ 343 \overline{) 1100} \\ \underline{1029} \\ 71 \end{array}$$

13. $18\dot{4}2\dot{0}(1357+, Ans.$

$$\begin{array}{r} 1 \\ 23 \overline{) 84} \\ \underline{69} \\ 265 \overline{) 1520} \\ \underline{1325} \\ 2707 \overline{) 19500} \\ \underline{18949} \\ 551 \end{array}$$

12. $1\dot{0}(3\dot{1}6+, Ans.$

$$\begin{array}{r} 9 \\ 61 \overline{) 100} \\ \underline{61} \\ 626 \overline{) 3900} \\ \underline{3756} \\ 144 \end{array}$$

$$\begin{array}{l} 14. \dot{4} \text{ Num. (2)} \\ \underline{4} \\ \dot{9} \text{ Denom. (2)} \\ \underline{9} \end{array} \left. \vphantom{\begin{array}{l} 14. \dot{4} \text{ Num. (2)} \\ \underline{4} \\ \dot{9} \text{ Denom. (2)} \\ \underline{9} \end{array}} \right\} = \frac{4}{9}, \text{ Ans.}$$

$$\begin{array}{l} 15. \dot{4} \text{ Num. (2)} \\ \underline{4} \\ \cdot 2\dot{5} \text{ Denom. (5)} \\ \underline{25} \end{array} \left. \vphantom{\begin{array}{l} 15. \dot{4} \text{ Num. (2)} \\ \underline{4} \\ \cdot 2\dot{5} \text{ Denom. (5)} \\ \underline{25} \end{array}} \right\} = \frac{4}{25}, \text{ Ans.}$$

$$\begin{array}{l} 16. 1\dot{6} \text{ Num. (4)} \\ \underline{16} \\ 10\dot{0} \text{ Denom. (10)} \\ \underline{1} \\ 00 \end{array} \left. \vphantom{\begin{array}{l} 16. 1\dot{6} \text{ Num. (4)} \\ \underline{16} \\ 10\dot{0} \text{ Denom. (10)} \\ \underline{1} \\ 00 \end{array}} \right\} = \frac{16}{100}, \text{ Ans.}$$

$$\begin{array}{l} 17. 8\dot{1} \text{ Num. (9)} \\ \underline{81} \\ 144 \text{ Denom. (12)} \\ \underline{1} \\ 22 \overline{) 44} \\ \underline{44} \end{array} \left. \vphantom{\begin{array}{l} 17. 8\dot{1} \text{ Num. (9)} \\ \underline{81} \\ 144 \text{ Denom. (12)} \\ \underline{1} \\ 22 \overline{) 44} \\ \underline{44} \end{array}} \right\} = \frac{81}{144}, \text{ Ans.}$$

18. $2\dot{0}2\dot{5}(4\dot{5}, Ans.$

$$\begin{array}{r} 16 \\ 85 \overline{) 425} \\ \underline{425} \end{array}$$

19. $\dot{7}5(866+, Ans.$

$$\begin{array}{r} 64 \\ 166 \overline{) 1100} \\ \underline{996} \\ 1726 \overline{) 10400} \\ \underline{10356} \\ 44 \end{array}$$

$$20. \frac{1}{11} = .833333 \text{ ('912+), Ans.}$$

$$\begin{array}{r} 81 \\ 181 \overline{) 233} \\ \underline{181} \end{array}$$

$$\begin{array}{r} 1822 \overline{) 5233} \\ \underline{3644} \\ 1589 \end{array}$$

¶ 210. Practical Exercises in the Extraction of the Square Root.

$$1. \overset{\text{men.}}{4096} (64, A. \quad 2. \overset{\text{rods.}}{2025} (45, A. \quad 3. \overset{\text{trees.}}{5625} (75, A.$$

$$\begin{array}{r} 124 \overline{) 496} \\ \underline{496} \end{array}$$

$$\begin{array}{r} 85 \overline{) 425} \\ \underline{425} \end{array}$$

$$\begin{array}{r} 145 \overline{) 725} \\ \underline{725} \end{array}$$

$$4. \overset{49}{5184} (72 \text{ ft., } A. \quad 5. 40 A. + 50 A. = 90 A., \text{ which } \times$$

$$\begin{array}{r} 142 \overline{) 284} \\ \underline{284} \end{array}$$

$$160 (\text{rods in } 1 A.) = 14400 P. (120 P., A.$$

$$\begin{array}{r} 1 \\ 22 \overline{) 44} \\ \underline{44} \\ 00 \end{array}$$

$$7. \sqrt{5 \text{ ft.} \times 5 \text{ ft.}} 4 = 10 \text{ ft., \&c., } Ans.$$

8. $\frac{1}{2}$ of 288 P. = 144 P., and $\sqrt{144} = 12$ rds. square. Two such fields, laid side by side, form a parallelogram 24 rods in length and 12 rods in breadth, *Ans.*

9. $\frac{1}{4}$ of 784 = $\sqrt{196} = 14$ rows of trees each way, and 4 such, laid side by side, would form an orchard of 14 rows and $(14 \times 4 =) 56$ trees in a row, *Ans.*

10. $\frac{1}{4}$ of 192 = $\sqrt{144} = 12$ rods square. The other 48 rods ($\frac{1}{4}$ of 192) will extend this field on one side $(48 \div 12 =) 4$ rods, forming a field 12 rods in breadth and 16 rods in length, *Ans.*

$$12. \sqrt{100 \times 100 \times 3} = 173.2 + \text{feet, } Ans.$$

$$13. \sqrt{12 \times 12 \div 4} = 6 \text{ inches, } Ans.$$

15. $6^2 = 36$, and $8^2 = 64$; then, $\sqrt{36 + 64} = 10$ feet, *Ans.*

$$16. 32^2 = 1024, \text{ and } 24^2 = 576; \text{ then, } \sqrt{1024 + 576} \text{ feet, } Ans.$$

17. $40^2 = 1600$, and $32^2 = 1024$; then, $\sqrt{1600 - 1024} = 24$ feet, *Ans.*

18. 40^2 (length of the ladder) $= 1600$, and 24^2 (width of the ditch) $= 576$; then, $\sqrt{1600 - 576} = 32$ feet, *Ans.*

19. By the question, each rafter becomes the hypotenuse of a right-angled triangle, with a perpendicular (12 feet) common to both. One half of the beam (16 feet) is base to the one, and the other half base to the other. $12^2 = 144$, and $16^2 = 256$; then, $\sqrt{144 + 256} = 20$ feet, *Ans.*

20. The projection of the eaves 1 foot each way will make the length of the roof 32 feet, and the breadth 24 feet. A diagonal line, extending from corner to corner, will be the hypotenuse of a horizontal right-angled triangle, of which the length and the breadth of the roof will form the two sides. Half the length of this line will be the distance from the post to the corners of the eaves. $32^2 = 1024$, and $24^2 = 576$; then, $\sqrt{1024 + 576} = 40$ ft., the half of which, 20 ft., is the distance from the posts to the corners of the eaves. Length of a rafter to the middle of one side, $10^2 = 100$, and $12^2 = 144$; then, $\sqrt{100 + 144} = 15.62$ feet, *Ans.* — rafter reaching to the middle of one end, $10^2 = 100$, and $16^2 = 256$; then, $\sqrt{100 + 256} = 18.86$ feet, *Ans.* — rafter reaching to the corners of the eaves, $10^2 = 100$, and $20^2 = 400$; then, $\sqrt{100 + 400} = 22.36$ feet, *Ans.*

21. $800^2 = 640000$, and $600^2 = 360000$; then, $640000 + 360000 = 1000$ rods between the corners, *Ans.*

22. $\sqrt{90 \times 160} = 120$ rods each side; $\sqrt{120^2 \times 2} = 169.7$ rods from corner to corner, *Ans.*

23. $\sqrt{10 \times 160} = 40$ rods each side of the field, and $\sqrt{40^2 \times 2} = 56.56$ rods, which $\div 2 = 28.28$ rods, distance of the centre from each corner, *Ans.*

Extraction of the Cube Root.

¶212. EXAMPLES FOR PRACTICE.

5.

373248 (72, *Ans.*

343

$$30^2 \times 3 = 14700 \quad \overline{30248}$$

$$14700 \times 2 = \overline{29400}$$

$$2^2 \times 70 \times 3 = \quad \overline{840}$$

$$2 \times 2 \times 2 = \quad \overline{8}$$

$$\overline{30248}$$

$$\overline{00000}$$

6. 21024576 (276, *Ans.*)

$$2 \times 2 \times 2 = 8$$

$$20^2 \times 3 = 1200 \quad 13024, \text{ 2d dividend.}$$

$$1200 \times 7 = 8400$$

$$7^2 \times 20 \times 3 = 2940$$

$$7 \times 7 \times 7 = 343$$

$$11683$$

$$270^2 \times 3 = 218700 \quad 1341576, \text{ 3d dividend.}$$

$$218700 \times 6 = 1312200$$

$$6^2 \times 270 \times 3 = 29160$$

$$6 \times 6 \times 6 = 216$$

$$1341576$$

$$0000000$$

7. 84604519 (439, *Ans.*)

$$4 \times 4 \times 4 = 64$$

$$40^2 \times 3 = 4800 \quad 20604$$

$$4800 \times 3 = 14400$$

$$3^2 \times 40 \times 3 = 1080$$

$$3 \times 3 \times 3 = 27$$

$$15507$$

$$430^2 \times 3 = 554700 \quad 5097519$$

$$554700 \times 9 = 4992300$$

$$9^2 \times 430 \times 3 = 104490$$

$$9 \times 9 \times 9 = 729$$

$$5097519$$

$$0000000$$

$$8. \sqrt[3]{.000343} = .07, A.$$

$$\begin{array}{r} 7 \times 7 \times 7 \times 343 \\ \hline 000 \end{array}$$

$$9. \sqrt[3]{1(125+)} = 1, A.$$

$$\begin{array}{r} 1 \times 1 \times 1 = 1 \\ 10^2 \times 3 = 300 \quad) \quad 1000 \\ \hline 300 \times 2 = 600 \\ 2^2 \times 10 \times 3 = 120 \\ 2 \times 2 \times 2 = 8 \\ \hline 728 \end{array}$$

$$120^2 \times 3 = 43200 \quad) \quad 272000$$

$$\begin{array}{l} 10. \left. \begin{array}{l} 2 \times 2 \times 2 = 8 \\ 27(3) \\ 3 \times 3 \times 3 = 27 \end{array} \right\} = 2, A. \quad \begin{array}{l} 43200 \times 5 = 216000 \\ 5^2 \times 120 \times 3 = 9000 \\ 5 \times 5 \times 5 = 125 \\ \hline 225125 \\ \hline 46875 \end{array} \end{array}$$

$$\begin{array}{l} 11. \left. \begin{array}{l} 5 \times 5 \times 5 = 125(5) \\ 216(6) \\ 6 \times 6 \times 6 = 216 \end{array} \right\} = 6, Ans. \quad \begin{array}{l} 12. \left. \begin{array}{l} 7 \times 7 \times 7 = 343(7) \\ 1728(12) \\ 1 \end{array} \right\} = 12, Ans. \end{array}$$

$$\begin{array}{r} 10^2 \times 3 = 300 \quad) \quad 728 \\ \hline 300 \times 2 = 600 \\ 2^2 \times 10 \times 3 = 120 \\ 2 \times 2 \times 2 = 8 \\ \hline 728 \\ \hline 000 \end{array}$$

$$13. \sqrt[3]{1(125+)} = 1, Ans.$$

$$\begin{array}{r} 10^2 \times 3 = 300 \quad) \quad 1000 \\ \hline 300 \times 2 = 600 \\ 2^2 \times 10 \times 3 = 120 \\ 2 \times 2 \times 2 = 8 \\ \hline 728 \end{array}$$

Carried forward.

$$120^2 \times 3 = 43200 \quad 272000 \quad \text{Brought forward.}$$

$$\begin{array}{r}
 43200 \times 5 = 216000 \\
 5^2 \times 120 \times 3 = 9000 \\
 5 \times 5 \times 5 = 125 \\
 \hline
 225125 \\
 46875
 \end{array}
 \quad
 \begin{array}{l}
 14. \\
 \frac{1}{1} \left(\begin{array}{l} 1 \\ 5 \end{array} \right) \left. \vphantom{\begin{array}{l} 1 \\ 5 \end{array}} \right\} = \frac{1}{5}, \\
 \hline
 125 \left(\begin{array}{l} 1 \\ 5 \end{array} \right) \left. \vphantom{\begin{array}{l} 1 \\ 5 \end{array}} \right\} \text{Ans.} \\
 5 \times 5 \times 5 = 125
 \end{array}$$

¶ 213. Practical Exercises in Extracting the Cube Root.

$$1. \quad 288 \times 216 \times 48 = 2985984 \quad (144 \text{ ft., Ans.})$$

$$10^2 \times 3 = 300 \quad 1985$$

$$\begin{array}{r}
 300 \times 4 = 1200 \\
 4^2 \times 10 \times 3 = 480 \\
 4 \times 4 \times 4 = 64 \\
 \hline
 1744
 \end{array}
 \quad
 2. \quad 2 \times 2 \times 2 = 8 \text{ ft., Ans.}$$

$$140^2 \times 3 = 58800 \quad 241984$$

$$\begin{array}{r}
 58800 \times 4 = 235200 \\
 4^2 \times 140 \times 3 = 6720 \\
 4 \times 4 \times 4 = 64 \\
 \hline
 241984 \\
 \hline
 000000
 \end{array}$$

$$3. \quad 8 \text{ ft.} \times 8 \text{ (times)} = 64 \quad (\text{solid ft.}) \quad 4 \text{ ft.} = \text{one side, Ans.}$$

$$4 \times 4 \times 4 = 64$$

$$4. \quad 5 \times 5 \times 5 = 125, \text{ which } \times 27 =$$

$$3375 \quad (15 \text{ ft.} = \text{one side, \&c.})$$

$$10^2 \times 3 = 300 \quad 2375$$

$$\begin{array}{r}
 300 \times 5 = 1500 \\
 5^2 \times 10 \times 3 = 750 \\
 5 \times 5 \times 5 = 125 \\
 \hline
 2375 \\
 \hline
 0000
 \end{array}$$

5. $1^3 = 1$, which $\times 8$ (times) $= \dot{8}$ (2 ft., *Ans.*
 $2 \times 2 \times 2 = 8$

Or, $\frac{27}{3 \times 3 \times 3} = 27$ (3 ft., *Ans.* Or, $\frac{64}{4 \times 4 \times 4} = 64$ (4 ft., *Ans.*

6. $4 : 32 :: (3^3 =) 27 : 216$ (6 in., *Ans.*
 $6 \times 6 \times 6 = 216$

7. $(6^3 =) 216 : (3^3 =) 27 :: 32 \text{ lb.} : 4 \text{ lb., } \textit{Ans.}$

8. $1^3 \text{ in.} = 1 \text{ in., and } (1 \text{ ft.} =) 12^3 \text{ in.} = 1728 \text{ in. diam.;}$
then, $1 \text{ in.} : 1728 \text{ in.} :: \$6 : \$10368, \textit{Ans.}$

9. $(40^3 =) 64000 \div (1^3 =) 1 = 64000$ of the smaller, *Ans.*

10. $112^3 = 1404928$ globes, large as the earth, to make one large as the sun, *Ans.*

11. 7900^3 (the earth's diam.) $= 493039000000$, which \times
 $1000 = 493039000000000$ (79000 miles, diam. of
 $7^3 = 343$ Saturn, *Ans.*

$70^2 \times 3 = 14700$ $\frac{150039}{14700 \times 9 = 132300}$

$9^2 \times 70 \times 3 = 17010$

$9^3 = 729$

$\frac{150039}{000000}$

000000

12. $2^3 = 8$ } $= \frac{8}{729}$, or as 8
 $9^3 = 729$ } to 729, *Ans.*

¶ 214. Review of Involution and Evolution.

EXERCISES.

1. 20 rds. \times 20 rds. $= 400 \text{ P., which } \times 6 = 2400 \text{ P., and}$
 $50 \text{ rds. } \times 50 \text{ rds.} = 2500 \text{ P.; then, } 2500 \text{ P.} - 2400 \text{ P.} =$
 $100 \text{ P., } \textit{Ans.}$

2. $10^3 \text{ ft.} = 1000 \text{ cu. ft. in 1 stack, which } \times 56 = 56000$
 $\text{cu. ft. in 56 stacks of the 1st size, and } 40^3 \text{ ft.} = 64000 \text{ cu. ft.}$
in 1 stack of the 2d size; then, $64000 \text{ cu.-ft.} - 56000 \text{ cu.}$
 $\text{ft.} = 8000 \text{ cu. ft., } \textit{Ans.}$

3. $(1 \text{ mi.} =) 320^2 \text{ rds.} = 102400$, and $40^2 \text{ rds.} = 1600$;
then, $102400 \div 1600 = 64$ times, *Ans.*

4. $128 \text{ cu. ft. } (= 1 \text{ C.}) \times 4 = 512 \text{ cu. ft., and } \sqrt[3]{512} \text{ cu.}$
 $\text{ft.} = 8 \text{ ft., length of one side, } \textit{Ans.}$

5. The side walls will each be 60 ft. long the whole height;
the end walls will each be 31 ft. 4 in. long, the 1st 12 ft.,
32 ft. long the next 12, and 32 ft. 8 in. the next 12. 120 ft. \div

$62\frac{1}{2}$ ft. = $182\frac{1}{2}$ ft., (length of the walls first 12 ft.,) which $\times 1\frac{1}{2}$ ft. (thickness) $\times 12$ ft. (height) = $2922\frac{3}{4}$ cu. ft., contents of the walls 12 ft. high; 120 ft. $+ 64$ ft. = 184 ft., (length of the walls next 12 ft.,) which $\times 1$ ft. (thickness) $\times 12$ ft. (height) = 2208 cu. ft., contents of the walls next 12 ft. high; 120 ft. $+ 65\frac{1}{2}$ ft. = $185\frac{1}{2}$ ft., (length of the walls last 12 ft.,) which $\times \frac{3}{4}$ ft. (thickness) $\times 12$ ft. (height) = $1482\frac{3}{4}$ cu. ft., contents of the walls last 12 ft. high; then, $2922\frac{3}{4}$ cu. ft. $+ 2208$ cu. ft. $+ 1482\frac{3}{4}$ cu. ft. = $6613\frac{1}{4}$ cu. ft., solid contents of the walls; and $\sqrt[3]{6613.333333} + \text{cu. ft.} = 18.77 + \text{ft.}$, length of one side of the cubical pile of bricks, *Ans.*

ARITHMETICAL PROGRESSION.

¶ 216. EXAMPLES FOR PRACTICE.

2. $23 - 1 = 22$, which $\times 4 = 88$, sum of the subtractions, and $95 - 88 = 7$, *Ans.*

3. $57 - 1 = 56$, which $\times 3 = 168$, sum of the additions, and $168 + 6 = 174$, *Ans.*

4. $15 - 1 = 14$, which $\times 8 = 112$, sum of the subtractions, and $117 - 112 = 5$, *Ans.*

5. $21 - 1 = 20$, which $\times 10 = 200$, and $200 + 6 = 206$, *Ans.*

¶ 217. Simple Interest by Progression.

2. Here 50 is the number of terms less one, $\$.07 \times 300 = \21 the common difference, and $\$300$ the first term; then, $\$21 \times 50 = \1050 , sum of the additions, which $+ \$300 = \1350 , *Ans.*

3. The first term is $\$25$, $\$.08 \times 25 = \2 the common difference, and 54 the number of terms less one; then, $\$2 \times 54 = \108 , which $+ \$25 = \133 , *Ans.*

¶ 218. *The extremes and the number of terms given, to find the common difference.*

EXAMPLES FOR PRACTICE.

2. $605 - 5 = 600$, which $\div (151 - 1) = 150 = 4$, *Ans.*

3. $45 - 10 = 35$, which $\div (8 - 1) = 7 = 5$, *Ans.*

4. $1205 - 5 = 1200$, which $\div 8 = 150$, and $150 + 1 = 151$, *Ans.*

¶ 219. *The extremes and the number of terms given, to find the sum of all the terms.*

EXAMPLES FOR PRACTICE.

2. $605 + 5 = 610$, which $\times 151 = 92110$, and $92110 \div 2 = 46055$, *Ans.*

3. $100 + 1 = 101$, which $\times 100 = 10100$, and $\frac{10100}{2} = 5050$, *Ans.*

4. $12 + 1 = 13$, which $\times 12 = 156$, and $\frac{156}{2} = 78$, *Ans.*

¶ 220. **Annuities by Arithmetical Progression.**

EXAMPLES FOR PRACTICE.

2. $\$147.84$ (amount of $\$96$ for 9 years) $+ \$96 = \243.84 , which $\times 10 = \$2438.40$, and $\frac{\$2438.40}{2} = \1219.20 , *Ans.*

3. Whole number of years, 61. $\$26$ (amount of $\$5$ for 60 years) $+ \$5 = \31 , which $\times 61 = \$1891$; $\$1891 \div 2 = \945.50 , which $+ \$300 = \1245.50 , *Ans.*

4. $\$149.20$ (amount of $\$40$ for 39 years) $+ \$40 = \189.20 , which $\times 40 = \$7568$; $\$7568 \div 2 = \3784 , which $+ \$1500 = \5284 , *Ans.*

5. $\$6342 \div 20 = \317.10 , gain in 1 year. $\$983.01$ (amount of $\$317.10$ for 30 years) $+ \$317.10 = \1300.11 , which $\times 31 = \$40303.41$, and $\$40303.41 \div 2 = \20151.705 , *Ans.*

¶ 221. **EXERCISES.**

1. The extremes are 30 and 0; then, $30 + 0 = 30$, which $\times 20 = 600$, and $\frac{600}{2} = 300$, *Ans.*

2. $\$75 + \$5 = \$80$, which $\times 11 = \$880$, and $\$880 \div 2 = \440 , whole debt; $\$75 - \$5 = \$70$, which $\div (11 - 1) = 10 = \$7$, common difference, *Ans.*

3. $1001 - 1 = 1000$, which $\div 2 = 500$, number of additions, and $500 + 1 = 501$, number of terms; then, $1001 + 1 = 1002$, which $\times 501 = 502002$, and $\frac{502002}{2} = 251001$, *Ans.*

4. $\$.04 + \$3.01 = \$3.05$, which $\times 100 = \$305$, and $\$305 \div 2 = \152.50 , *Ans.*

5. $\$1570$ is the sum of the series, 20 years the number of terms, and $\$.06$ is the common difference of a series of which $\$1$ is the 1st term. Hence the operation is the reverse of ¶ 219. $\$1570 \times 2 = \3140 , (twice the series,) which $\div 20$ (the number of terms) $= \$157$, the sum of the extremes of a series of which $\$1$ is the first term, 20 the number of terms,

and \$1.06 the common difference; then, \$2.14 (amount of \$1 for 19 years) + \$1 = \$3.14, and $\$157 \div \$3.14 = \$50$, *Ans.*

6. $50 - 1 = 49$, which $\times \frac{1}{2} = 24\frac{1}{2}$, sum of the additions, and $24\frac{1}{2} + 2 = 26\frac{1}{2}$, last term; then, $26\frac{1}{2} + 2 = 28\frac{1}{2}$, which $\times 50 = 1425$, and $1425 = 712\frac{1}{2}$, *Ans.*

7. $30 - 0 = 30$, which $\div \frac{1}{3} = 90$, and $90 + 1 = 91$, number of terms; then, $(30 + 0) 30 \times 91 = 2730$, which $\div 2 = 1365$, *Ans.*

8. The number of terms is 59. \$117 (amount of \$30 for 58 years) + \$30 = \$147, which $\times 59 = \$8673$, and $\$8673 \div 2 = \4336.50 , *Ans.*

GEOMETRICAL PROGRESSION.

T 223. EXAMPLES FOR PRACTICE.

2.

NOTE. The 4 kernels planted is the first term, and the 32 kernels harvested the second, both within the first year; it follows, therefore, that the number of terms in this example is 1 more than the number of years.

Indices: 1, 2, 3, 4, 5, }
Powers: 8, 64, 512, 4096, 32768; } then, $1 + 2 + 3 + 4 + 5 = 15$, an index less by 1 than the number of terms; multiplying the powers of these several indices, we have $32768 \times 4096 \times 512 \times 64 \times 8 = 3518437208832$, which $\times 4$ (the first term) = 140737488355328 , number of kernels, $\div 1000$ (number of kernels in a pint) = 140737488355.328 pints $\div 64$ (number of pints in a bushel) = 2199023255.552 bush., *Ans.*

3. $1824 - 1620 = 204$, which $\div 12 = 17$, number of terms less one; then, $2^{17} = 131072$, which $\times \$01 = \131072 , *Ans.*

4. $3^6 = 729$, which $\times 5 = 3645$, *Ans.*

5. $3^7 = 2187$, and $10935 \div 2187 = 5$, *Ans.*

6. $2^{16} = 65536$, and $196608 \div 65536 = 3$, *Ans.*

7. $700000000 \div 7 = 100000000$, which may be divided by the ratio, 10, the quotient thence arising by 10, and so on for 8 divisions; then, 8 (divisions by the ratio) + 1 (division by the first term) = 9, the number of terms, *Ans.*

Compound Interest by Progression.

¶ 224. EXAMPLES FOR PRACTICE.

2. $1.05^{11} = 1.71033+$, and $\$40 \times 1.71033 = \$68.413+$,
Ans.

3. $1.10^4 = 1.4641$, and $\$6 \times 1.4641 = \8.7846 , *Ans.*

4. $\$1191.016 \div \$1000 = 1.191016$, which may be divided by 1.06, and the quotient thence arising by 1.06, and this last quotient by 1.06; then, the three divisions = 3 years,
Ans.

¶ 226. *The extremes and the ratio given, to find the sum of the series.*

EXAMPLES FOR PRACTICE.

2. $131072 \times 8 = 1048576$, which $- 4 = 1048572$, and $1048572 \div 7 = 149796$, *Ans.*

3. $3 \times 3 = 9$, which $- 0 = 9$, and $9 \div 2 = 4\frac{1}{2}$, *Ans.*

4. $1 \times 4 = 4$, which $- 0 = 4$, and $4 \div 3 = 1\frac{1}{3}$, *Ans.*

5. $\frac{1}{10} \times 10 = 1$, which $- 0 = 1$, and $1 \div 9 = \frac{1}{9}$, *Ans.*

6. $\frac{1}{160} \times 100 = 2$, which $- 0 = 2$, and $2 \div 99 = \frac{2}{99}$,
Ans.

¶ 227. *The first term, ratio, and number of terms given, to find the sum of the series.*

EXAMPLES FOR PRACTICE.

3. $10^{40} = 1$ with forty ciphers annexed, which $- 1$ would = forty 9s; then, $\div 10 - 1 =$ forty 1s, the number of kernels, which $\div 1000 =$ number of pints, and this dividend $\div 64$ (number of pints in a bushel) = number of bushels, which $\times '50 =$ *Ans.*

Annuities at Compound Interest.

¶ 228. EXAMPLES FOR PRACTICE.

2. $\frac{1.05^{30} - 1}{1.05 - 1} = \frac{2.65329 - 1}{1.05 - 1} = \frac{1.65329}{.05} = 33.0658$, which
 $\times \$50$ (the annuity) = $\$1653.29$, *Ans.*

3. $\frac{1.10^4 - 1}{1.10 - 1} = \frac{1.4641 - 1}{1.10 - 1} = \frac{.4641}{.10} = 4.641$, which \times
 $\$150$ (the annuity) = $\$696.15$, *Ans.*

4. $\frac{1.06^{24} - 1}{1.06 - 1} = \frac{4.048930}{1.06 - 1} = \frac{1.3048930}{.06} = 50.8155$,
 which $\times \$500 = \25407.75 , *Ans. to the last.*
5. $\$200 \times .20 = \40 ; then, $\frac{1.06^{10} - 1}{1.06 - 1} = \frac{10.285718 - 1}{1.06 - 1} = \frac{9.285718}{.06} = 154.7619\frac{2}{3}$, which $\times \$40 = \$6190.478\frac{2}{3}$, *Ans.*
6. $\frac{1.06^{30} - 1}{1.06 - 1} = \frac{5.743491 - 1}{1.06 - 1} = \frac{4.743491}{.06} = 79.0581\frac{1}{3}$,
 which $\times \$100 = \$7905.818\frac{1}{3}$, *Ans.*

Present Worth of Annuities at Compound Interest.

¶ 229. EXAMPLES FOR PRACTICE.

2. $\frac{1.06^4 - 1}{1.06 - 1} = \frac{1.26247 - 1}{1.06 - 1} = 4.3745$, which $\times \$100$
 (the annual pension) = $\$437.45$; and $\$437.45 \div \1.26247
 (amount of \$1 for 4 years) = $\$346.503+$, *Ans.*
3. $\frac{1.05^{20} - 1}{1.05 - 1} = \frac{2.65329 - 1}{1.05 - 1} = 33.0658$, which $\times \$100$
 = $\$3306.58$, and this sum $\div \$2.65329$ (amount of \$1 for 20
 years) = $\$1246.218+$, *Ans.*

¶ 230. EXAMPLES FOR PRACTICE.

1. $\$15.37245$ (present worth of \$1) $\times 150$ (= \$150 annu-
 ity) = $\$2305.8675$, *Ans.*
2. $\$16.1929 \times 40 = \647.716 , *Ans. to last.*

Annuities at Compound Interest in Reversion.

¶ 231. EXAMPLES FOR PRACTICE.

3. $\$3.4651$ (present worth of \$1 annuity) $\times 100 =$
 $\$346.51$, which $\div \$1.1236$ (amount of \$1 for 2 years at 6
 per cent., compound interest) = $\$308.392+$, *Ans.*
4. *The last.* Present worth, to commence immediately,
 $\$1246.221$, which $\div 1.97993$ (1.05^{14}) = $\$629.426$, *Ans.* Or,
 by the table, whole time, 34 years, = $\$16.1929$
 Time in reversion, 14 years, = $\$9.89864$

Difference, $\$6.29426$, which \times
 100 (the annuity) = $\$629.426$, *Ans.* as before.

5. $1840 - 1817 = 23$ years, whole time the pension con-

tinued; $1817 - 1783 = 34$ years, whole time in reversion;
 $\$12\cdot30338$ (present worth of \$1 annuity for 23 years) $\times 96$
 $= \$1181\cdot12448$, present worth to commence immediately,
 which $\div 7\cdot251025$ ($1\cdot06^3$) $= \$162\cdot89+$, *Ans.*

¶ 232. Perpetual Annuities.

2. $\$800 \div \cdot07 = \$11428\cdot57+$, *Ans.*
3. $\$100 \div \cdot20 = \500 , *Ans.*
5. $\$100 \div \cdot05 = \2000 , worth, if entered on now, which
 $-\$1537\cdot245$ (present worth of 100 for 30 years) $=$
 $\$462\cdot755$, *Ans.*

PERMUTATION.

- ¶ 233. 2. $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 =$
 362880 , *Ans.*
3. $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times$
 $12 \times 13 \times 14 \times 15 \times 16 \times 17 \times 18 \times 19 \times 20 \times 21 \times$
 $22 \times 23 \times 24 \times 25 = \$15511210043330985984000000$, *Ans.*
4. $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 = 40320$, *Ans.*

MISCELLANEOUS EXAMPLES.

- ¶ 234. 1. $(7 + 4 =) 11 - (2 + 3 =) 5 = 6$, $6 + 40$
 $= 46$, and $46 \times 5 = 230$, *Ans.*
2. $990 - 90 = 900$, (their sum if the numbers were each
 equal to the smaller,) $900 \div 2 = 450$, the smaller number,
 and $450 + 90 = 540$, the larger number, *Ans.*
3. The least number of pounds is the least common mul-
 tiple of all the given numbers, ¶ 73, Note 2.
- | | |
|--------------------|-----------------------------------------------------------|
| 2) 48, 76, 87, 90, | |
| 3) 24, 38, 87, 45, | |
| 2) 8, 38, 29, 15, | $2 \times 3 \times 2 \times 4 \times 19 \times 29 \times$ |
| 4, 19, 29, 15, | $15 = 396720$, <i>Ans.</i> |
4. 2s. 3d. $= 27$ d., which $\times \cdot02\frac{9}{10} = \$54\frac{9}{10}$; $\$54\frac{9}{10} \times 15$
 $= \$816\frac{3}{4}$, cost of the cloth, which $\div \$1\cdot50 = 52\frac{9}{10}$ bushels,
Ans.
5. If \$30 gain \$.05, \$.01 will gain $\frac{1}{30}$ of \$.05 $= \frac{1}{6}$ of 1
 cent, and $(\$3\cdot75 =) 375$ cents will gain 375 times $\frac{1}{6}$ of 1 cent
 $= \$62\frac{1}{2}$, which $+ \$3\cdot75 = \$4\cdot37\frac{1}{2}$, *Ans.*; or, $\$30 : \$35 ::$
 $\$3\cdot75 : \$4\cdot37\frac{1}{2}$, *Ans.* as before.

6. I paid 100 per cent. — $33\frac{1}{3}$ per cent. = $66\frac{2}{3}$ per cent. of the cost; $\$4.50 \times .66\frac{2}{3} = \3.00 , *Ans.*

7. $\$42 \times .15 = \6.30 ; then, $\$42 + \$6.30 = \$48.30$, price of the whole, and $\$48.30 \div 120 = \$40\frac{1}{4}$, *Ans.*

8. $\$150 \div \$1.15 = \$130.434$, *Ans.*

9. $\$1000 \div \$1.25 = \$800$, *Ans.*

10. $\$4.25 - \$3.50 = \$.75$, gain on 1 yard; $\frac{.75}{3.50} = .21\frac{3}{7} = 21\frac{3}{7}$ per cent., *Ans.*

11. $20 \times 60 = 1200$ men will build it in 1 day, and $1200 \div 50 = 24$ men will build it in 50 days, *Ans.*

12. $12 \times \frac{5}{8} = \frac{60}{8}$, contents of the plaid, which $\div (1\frac{1}{2} = \frac{3}{2})$ (contents of 1 yd. of Silesia) = 5 yards, *Ans.*

13. $\frac{1}{4} - \frac{2}{8} = \frac{3}{8}$ of a gallon in 1 minute; then, $400 \div \frac{3}{8} = 375$ minutes = 6 hours 15 minutes *Ans.*

14. $\frac{1}{10} - \frac{1}{15} = \frac{1}{30}$ part filled in 1 hour; then, $1 \div \frac{1}{30} = 30$ hours, *Ans.*

15. $\$500$ for 4 mo. = $\$2000$ for 1 mo., and $\$2000$ for 1 mo. = $\$300$ for $\frac{2000}{3000} = 6\frac{2}{3}$ mo., *Ans.*

16. $800 \times 2 = 1600$ men can be served 1 mo., and $\frac{1600}{5} = 320$ men can be served 5 mo.; then, $800 - 320 = 480$ men, *Ans.*

17. $(45 - 16 =) 29 \times \$3.50 = \101.50 , cost of the better kind; and $(16 \times \frac{3}{4} =) 12 \times \$3.50 = \$42.00$, cost of the poorer kind; then, $\$101.50 + \$42.00 = \$143.50$, *Ans.*

18. $57 \div 4 (40 - 36) = 14\frac{1}{4}$ minutes; and $40 \times 14\frac{1}{4} = 570$ rods, *Ans.*

19. $11 : 12 :: 1 : A. = 12 \div 11 = 1\frac{1}{11}$ hours = 1 hour 5 minutes $27\frac{3}{11}$ seconds, *Ans.*

20. B travels twice, and C three times, as fast as A; therefore, when A has travelled round once, B will have been round twice, and C three times, and there they will all be together for the first time; therefore, $20 \div 2 = 10$, number of hours A will be in passing round once. *Ans.*, 10 hours.

21. One moves 6, and the other 10 miles per hour, and both together 16; then, one will go $\frac{6}{16}$, and the other, $\frac{10}{16}$ of the whole distance; therefore, $300 \times \frac{6}{16} = 112\frac{1}{2}$, and $300 \times \frac{10}{16} = 187\frac{1}{2}$; or, $16 : 6 :: 300 : 112\frac{1}{2}$ miles, and $16 : 10 :: 300 : 187\frac{1}{2}$ miles, *Ans.*, as before.

22. $\frac{1}{3} + \frac{1}{4} = \frac{7}{12}$ of the army; therefore, 1000 is $\frac{5}{12}$ of the whole army; $1000 \div 5 = 200 = \frac{1}{12}$ of the army, which $\times 12 = 2400$, *Ans.*

23. $1 - \frac{1}{24} (\frac{1}{4} + \frac{1}{8} + \frac{1}{8} + \frac{1}{12}) = \frac{9}{24}$; then 450 is $\frac{9}{24}$ of

the whole; therefore, $450 \div 9 = 50$, which $\times 24 = 1200$, *Ans.*

24. $1 - 1\frac{4}{5} (\frac{1}{5} + \frac{4}{5}) = 1\frac{1}{5}$; 6 is $1\frac{1}{5}$; then, $6 \times 15 = 90$ feet, *Ans.*

25. $1 - 7\frac{1}{3} (\frac{1}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3}) = \frac{2}{3}$; 9 is $\frac{2}{3}$ of the whole; then, $(9 \div \frac{2}{3}) 1 \times 80 = 80$, whole number. *Ans.*

26. $100 - 2\frac{1}{2} = 97\frac{1}{2}$, which is $\frac{3}{2}$ of the whole flock; and $97\frac{1}{2} \div 3 = 32\frac{1}{2}$, which $\times 2 = 65$ geese, *Ans.*

27. $1 - 1\frac{1}{2} (\frac{1}{2} + \frac{1}{2} + \frac{1}{2}) = 1\frac{1}{2}$; then, 100 is $1\frac{1}{2}$, and $100 \times 12 = 1200$, *Ans.*

28. $\frac{7}{8} - \frac{4}{8} = \frac{3}{8}$; then, 6 is $\frac{3}{8}$ of the number; $6 \div \frac{3}{8} = 2 = \frac{1}{4}$ of the number, which $\times 40 = 80$, *Ans.*

29. $84 = \frac{7}{4}$ of the number; then, $84 \div 7 = 12$, which $\times 4 = 48$, *Ans.*

30. $93 = 1 + 1\frac{1}{2} + 5\frac{1}{4} = 7\frac{3}{4}$ times A's age; then, $93 \div 7\frac{3}{4} = 12$, A's; $12 \times 1\frac{1}{2} = 18$, B's; and $12 \times 5\frac{1}{4} = 63$, C's, *Ans.*

31. $435 = 1 + 1 + \frac{3}{4} + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} = 2\frac{3}{8}$ of his sheep; then, $435 \div 2\frac{3}{8} = 15$, which $\times 8 = 120$, *Ans.*

32. $22 = (3 - 2\frac{4}{5}) = 1\frac{1}{5}$ of the number sought; then, $22 \div 1\frac{1}{5} = 30$, *Ans.*

33. ($\frac{1}{2}$ of $\frac{2}{3} = \frac{1}{3}$, that is,) $\frac{2}{3}$ of the stock, is equal to $\frac{1}{3}$, that is, the whole stock, less \$200; consequently \$200 is $\frac{2}{3}$ of the stock; $\$200 \div \frac{2}{3} = \300 , which $\times 5 = \$1500$, *Ans.*

34. Had he worked every day, his wages would have been $\$75 \times 50 = \3750 , that is, \$10 more than he received; but every day he was idle lessened his wages $\$75 + \$25 = \$100$; consequently he was idle 10 days, and 50 days — 10 days = 40 days, *Ans.*

35. $\$40 \div \$8 = \$5$, what B spends more than his income, in a year; then, $\$30 - \$5 = \$25$, which must be $\frac{1}{8}$ of their income; $\$25 \times 8 = \200 , whole income of each; and $\$200 \times \frac{7}{8} = \175 , what A spends; and $\$175 + \$20 = \$195$, what B spends.

36. A has $\frac{1}{2} - \$20$, and C $\frac{1}{2} - \$30$; then, A and C have the whole — \$50, which must be B's share, or $\frac{1}{4}$; then, $\$50 \times 4 = \200 , whole estate; and $200 \div 2 = \$100$, which — 20 = \$80, A's share; $\$200 \div 4 = \50 , B's share; and $\$200 \div 2 = \100 , which — \$30 = \$70, C's share.

37. The length of the body is $\frac{1}{2}$ the length of the whole fish; the length of the tail is $\frac{1}{4} + 4$ feet; and the head is 4 feet; then, $\frac{1}{2} + \frac{1}{4} + 4 + 4 = (\frac{3}{4} + 8) = 8\frac{3}{4}$ whole length of

the fish, and consequently $8 = \frac{1}{4}$, and $8 \times 4 = 32$ feet, *Ans.*

38. A can do $\frac{1}{4}$, and B $\frac{1}{8}$, per day, and both, working together, $\frac{1}{4} + \frac{1}{8} = \frac{3}{8}$; then, $1 \div \frac{3}{8} = 1\frac{1}{3}$ days, *Ans.*

39. A and B can do $\frac{1}{4}$, B and C $\frac{1}{8}$, and A and C $\frac{1}{5}$, per day; then, $\frac{1}{4} + \frac{1}{8} + \frac{1}{5} = \frac{37}{80}$, which $\div 2$ (because each man, by the conditions, is taken twice) $= \frac{37}{160}$ what all would do in 1 day; then, $1 \div \frac{37}{160} = 3\frac{3}{7}$ days, *Ans.*

40. A and B together can do $\frac{1}{5}$, and A can do $\frac{1}{7}$ alone; then, $\frac{1}{5} - \frac{1}{7} = \frac{2}{35}$ what B can do in a day; then, $1 \div \frac{2}{35} = 17\frac{1}{2}$ days, *Ans.*

41. Am't of \$1.00 for (21-18) 3 yrs. = \$1.18 }
Am't of \$1.00 for (21-14) 7 yrs. = \$1.42 } = \$2.60.

Then, (as they will receive inversely as the time,)

\$2.60 : \$1.42 :: \$1000 : \$546.153+, the elder br.'s share.

\$2.60 : \$1.18 :: \$1000 : \$453.846+, the younger br.'s share.

42. \$60 is the first term, \$06 the common difference, and 5 the number of terms; then, $4 \times \$06 = \24 , which $\times \$60 = \14.40 , and $\$14.40 + \$60 = \$74.40$, the last term; then, $\$74.40 + \$60 = \$134.40$, which $\times 5 = \$672$, and $\$672 \div 2 = \336 , *Ans.*

43. $30 \times 3 = 90$, which $\times \$50 = \45.00 , price of 100 yards calico; and $\$45 \div 100 = \45 , price of 1 yard of calico; $\$45 \times 40 = \18 , which $\div (12 \times 3 =) 36 = \50 , price of 1 pair of gloves; then, $\$4 \div \$50 = 8 = 8$ pairs, *Ans.*

44. B has \$3, and C \$7, more than A; $\$3 + \$7 = \$10$, which, taken from \$100 = \$90, and $\$90 \div 3 = \30 , A's share; $\$30 + \$3 = \$33$, B's share; and $\$30 + \$7 = \$37$, C's share, *Ans.*

45. 30 gal. = 240 pts., which $\div 3$ pts. (2 pts. + 1 pt.) = 80. *Ans.*

46. 12 cwt. 3 qrs. 12 lbs. = 1440 lbs., which $\div 24$ lbs. (12 lbs. + 7 lbs. + 5 lbs.) = 60, *Ans.*

47. 15 oz. 6 pwt. = 7344 grs.; 12 pwt. = 288 grs., which + 18 grs. = 306 grs.; then, $7344 \text{ grs.} \div 306 \text{ grs.} = 24$, *Ans.*

48. $3 + 5 + 7 = 15$ cts.; then, the first will have $\frac{1}{5}$ of 60 = 12; the second $\frac{1}{5}$ of 60 = 20; and the third, $\frac{1}{5}$ of 60 = 28, *Ans.*

49. Since there were 3 women to every boy, and 6 men to every boy, as often as he gave \$06 to a boy, he gave \$08 $\times 3 = \$24$ to a woman, and $\$16 \times 6 = \96 to a man; then, $\$06 + \$24 + \$96 = \126 ; $\$18.90 \div \$126 = 15$ boys; $15 \times 3 = 45$ women; and $15 \times 6 = 90$ men, *Ans.*

50. $\$82.50 = 1 + 8 + 24 = 33$ times the price of the

sheep; then, $\$82.50 \times \frac{1}{3} = \27.50 , sheep; $\$82.50 \times \frac{2}{3} = \55.00 , cow; and $\$82.50 \times \frac{1}{3} = \27.50 , oxen, *Ans.*

51. $1 - \frac{1}{4} (\frac{1}{2} + \frac{1}{4}) = \frac{1}{4}$, what C furnished; then, $\$1250 \times \frac{1}{4} = \312.50 , A's; $\$1250 \times \frac{1}{2} = \625.00 , B's; and $\$1250 \times \frac{1}{4} = \312.50 , C's share, *Ans.*

52. First, to find the gain of A and B; C's gain being $\$120$, $\$332.50 - \$120 = \$212.50$, the gain of A and B together; then, $\$850 : \$500 :: \$212.50 : \125 , A's; and $\$850 : \$350 :: \$212.50 : \87.50 , B's. To find the price of C's cloth per yard; if C's share of the gain is $\frac{1}{3}$ of the whole gain, his share of the stock must have been $\frac{1}{3}$ of the whole; and $1 - \frac{1}{3} = \frac{2}{3}$ must be equal to A and B's stock together, viz. $\$850$; then, $\$850 \div \frac{2}{3} = \1275 , $\frac{1}{3}$ of the stock, which $\times 43$ (C's share) = $\$5497.50$, C's stock, which $\div 120 = \$45.81$ per yard, *Ans.*

53. As often as A paid $\$5$, B paid $\$7$, and C $\$10.50$; $\$5 + \$7 + \$10.50 = \22.50 ; then, $\$22.50 : \$5 :: \$580.80 : 129.066\frac{2}{3}$, A's; $\$22.50 : \$7 :: \$580.80 : 180.693\frac{1}{3}$, B's; and $\$22.50 : \$10.50 :: \$580.80 : 271.04$, C's, *Ans.*

54. As often as A had $\$9$, B had $\$5$, and C $\frac{1}{2}$ of $\$5 = \2.50 ; $\$9 + \$5 + \$2.50 = \16.50 ; then, $\$2.50 : \$16.50 :: \$7442.105 : \$56063.857\frac{1}{2}$, *Ans.*

55. 9 months : 12 months :: $\$1200 : \1600 , *Ans.*

56. $\frac{1}{4} + \frac{1}{10} + \frac{1}{20} = \frac{1}{5}$, which $\div 2$ (as each man's horses are taken twice in the question) = $\frac{1}{10}$; then, $\frac{1}{10} - \frac{1}{4}$ (A's and B's) = $-\frac{3}{20}$, C's; $\frac{1}{10} - \frac{1}{20}$ (A's and C's) = $\frac{1}{20}$, B's; and $\frac{1}{10} - \frac{1}{20}$ (B's and C's) = $\frac{1}{20}$, A's; then, A will have $\frac{1}{20}$ of $\$26.45 = \1.3225 ; B will have $\frac{1}{20} = \$1.3225$, and C $\frac{1}{20} = \$1.3225$.

57. $\$2178 \div \frac{1}{3} = \6534 , the money he had *after* he bought his commission, to which $+\$7260 = \13794 , what he had *before* he bought his commission; this must be $\frac{1}{4}$ ($\frac{1}{4} - \frac{1}{4}$) of his fortune; then, $\$13794 \div \frac{1}{4} = \55176 , *Ans.*

58. $1560\text{£} \div \frac{1}{2} = 3120\text{£}$, the elder brother's fortune, which $\times \frac{1}{2}$ ($5\frac{1}{2}$) = 1560£ , which is $\frac{2}{3}$ of twice as much as the father was worth; then, $1560\text{£} \div \frac{2}{3} = 2340\text{£}$, which $\div 2 = 1170\text{£}$, *Ans.*

59. $\frac{1}{4}$ of $\frac{1}{2}$ = $\frac{1}{8}$; then, 537£ is $\frac{1}{8}$ = 4304£ , and $537\text{£} \div \frac{1}{8} = 4304\text{£}$, the sum he had *after* he had spent $\frac{1}{8}$ of his fortune, and consequently this must be $\frac{1}{8}$ of what he had at first; then, $4304\text{£} \div \frac{1}{8} = 34432\text{£}$, *Ans.*

60. $231 + 44 = 275$ is the whole number of men added to two sides; but since the man at the corner is counted twice, we $+ 1$ to $275 = 276$, which $\div 2 = 138$, the number of

men on a side after the addition; then, $138^2 = 19044$, which $- 44 = 19000$, *Ans.*

61. $40 \times 40 = 1600$, the last number, which $\div 4 = 400$, the second number, and this $\div 4 = 100$, first number, *Ans.*

62. $100^2 - 80^2 = 10000 - 6400 = 3600$; then, $\sqrt{3600} = 60$, height of the steeple, which $\times 3 = 180$, height of the spire; to find the length of the line, $180^2 + 80^2 = 32400 + 6400 = 38800$, and $\sqrt{38800} = 197$ feet, nearly, *Ans.*

63. $7\frac{1}{2}^2 + 10^2 = 15^2 + 20^2 = 225 + 400 = 625$; then, $\sqrt{625} = 25 = 12\frac{1}{2}$ miles apart in 1 hour, which $\times 24 = 300$ in one day, which $\times 3 = 900$, *Ans.*

64. $70 \cdot 71^2 = 5000$ P., (nearly,) twice the area, which $\div 2 = 2500$ P., area; 2500 P. $= 15\frac{3}{4}$ A., *Ans.*

65. $5250^3 = 147197952000$ cu. ft. in 1 cu. mi.; 1320 (ft. wide) $\times 10$ (ft. deep) $\times 21120$ (ft. in 4 mi.) $= 278784000$ cu. ft. discharged in 1 hour; then, $147197952000 \div 278784000 = 528$ hours $= 22$ days, *Ans.*

66. $380 \times 120 = 45600$; then, $45600 : 62700000 :: 1 : A. = 62700000 \div 45600 = 1375$ times, *Ans.*

67. 24 h. $\times 365 = 8760$ h., which $\div 528$ h. (22 d. $= 16\frac{2}{3}$, (cu. mi.)) what the Po will discharge in 365 days, which $\times 1375 = 22812\frac{1}{2}$ cu. mi., *Ans.*

68. $5 : 10\frac{1}{2} :: 62700000 : A. = 62700000 \times 10\frac{1}{2} = 658350000$, which $\div 5 = 131670000$, number of square miles of water, which $\times 1\frac{1}{2} = 197505000$, number of cu. miles in the ocean, which $\div 22812\frac{1}{2}$ (number of cu. miles of water discharged by all the rivers into the sea in 1 year) $= 8657$ years 275 days, *Ans.*

69. 1000 oz. $\times 13\frac{1}{2} \times 2\frac{1}{2}$ (30 in. $= 2\frac{1}{2}$ ft.) $= 33750$ oz., which $\div 16 = 2109\frac{3}{4}$ lbs. on a square foot; then, $2109\frac{3}{4}$ lbs. $\times 27878400$ (5280^2) $= 58806000000$ lbs. on a square mile; and 131670000 (square miles of water) $+ 62700000$ (square miles of land) $= 194370000$ square miles on the surface of the globe, which $\times 58806000000$ (lbs. on 1 square mile) $= 114301222000000000$ lbs., weight of the whole atmosphere, *Ans.*

70. Detroit being west of Boston, his watch was too fast; $82^\circ 58' - 71^\circ 4' = 11^\circ 54'$, difference in longitude, which $\times 4 = 47$ m. 36 s. too fast, *Ans.*

71. $90^\circ 15' - 70^\circ 20' = 19^\circ 55'$, difference in longitude, which $\times 4 = 1$ h. 19 m. 40 s., difference in time, and this $- 3$ m. $= 1$ h. 16 m. 40 s., to be taken from the time at Portland; 9 h. $- 1$ h. 16 m. 40 s. $= 7$ h. 43 m. 20 s., *Ans.*

72. 120 miles $= 633600$ feet, which $\div 1142$ ft. $= 554 +$ seconds $= 9$ minutes $14 +$ seconds, *Ans.*

73. $1142 \text{ ft.} \times 8 = 9136 \text{ ft.} = 1 \text{ mi. } 3856 \text{ ft., Ans. } \frac{1}{2}$

74. $2 \text{ s.} \times 3 = 6 \text{ s., and } 1142 \text{ ft.} \times 6 = 6852 \text{ ft.} = 1 \text{ mi. } 1572 \text{ ft., Ans.}$

75. By the conditions, the width is 3 times, and the length 6 times the depth; $144 \text{ cu. yds.} \div 3 = 48 \text{ cu. yds.}$ in a portion of the cellar $\frac{1}{3}$ the whole width, and $48 \text{ cu. yds.} \div 6 = 8 \text{ cu. yds.}$ in a portion of the same length and width as the whole depth of the cellar; then, $8 \text{ cu. yds.} = 216 \text{ cu. ft.,}$
 $\sqrt[3]{216} = 6 \text{ ft.,}$ depth of the cellar, which $\times 6 = 36 \text{ ft.,}$ length, *Ans.*

76. Less money more time; $\$45\overset{3}{0} : \$75\overset{5}{0} :: 8 \text{ months} : 1 \text{ year } 1 \text{ month } 10 \text{ days, Ans.}$

77. $3 + 5 = 8$; then, $8 : 5 :: 266\frac{2}{3} : 166\frac{2}{3}$, the greater number, and $8 : 3 :: 266\frac{2}{3} : 100$, the less, *Ans.*

78. $10^2 = 100$ square rods, which — 19 square rods = 81 square rods of the park not occupied by the walk; $\sqrt{81} = 9$ rods, 1 side of the square enclosed by the walk; then, $10 \text{ rods} - 9 \text{ rods} = 1 \text{ rod} = 16\frac{1}{2} \text{ ft.,}$ which $\div 2$ (as the walk is twice measured in measuring 1 side of the park) = 8 ft. 3 in., *Ans.*

79. 7 is the sum, and 1 the difference, of B and C's proportions of the whole stock; $7 - 1 = 6$, which $\div 2 = 3 =$ B's proportion of the stock, († 234, Ex. 2.) $7 - 3 = 4 =$ C's proportion, and 5 (the sum of A and B's proportions) — 3 (B's proportion) = 2 = A's proportion; $2 + 3 + 4 = 9 =$ sum of their proportions; then, A had $\frac{2}{9}$ of $\$610.65 = \135.70 , B had $\frac{3}{9} = \$203.55$, and C had $\frac{4}{9} = \$271.40$, *Ans.*

MEASUREMENT OF SURFACES.

† 235. 1. $80 \text{ rds.} \times 20 \text{ rds.} = 1600 \text{ P., Ans.}$

3. $\frac{1^8 + 1^8}{2} = 1.55 \text{ ft.,}$ which $\times 16 \text{ ft.} = 24.8 \text{ sq. ft., Ans.}$

4. $30 \text{ rds.} \times 5 \text{ rds. } (\frac{1}{2} \text{ rds.}) = 150 \text{ P., Ans.}$

5. $600 \text{ P.} \div 75 \text{ rds.} = 8 \text{ rds.,}$ which $\times 2 = 16 \text{ rds., Ans.}$

6. $40 \text{ rds.} \div 2 = 20 \text{ rds.,}$ ($\frac{1}{2}$ the altitude,) and $400 \text{ P.} \div 20 \text{ rds.} = 20 \text{ rds., Ans.}$

7. $\frac{1\frac{1}{2} + 0}{2} = \frac{3}{4} \text{ ft.,}$ which $\times 18 \text{ ft.} = 13\frac{1}{2} \text{ sq. ft., Ans.}$

8. $147 \text{ ft.} \times 3\frac{1}{2} = 462 \text{ ft.,}$ circumference; $147 \text{ ft.} \times 147 \text{ ft.} \times .7854 = 16971.7 + \text{sq. ft., Ans.}$

9. $22 \text{ ft.} \div 3\frac{1}{2} = 7 \text{ ft., Ans.}$

10. $7911 \text{ mi.} \times 3.14159 = 24853 \text{ mi., nearly, Ans.}$

11. $3\frac{1}{2} \text{ in.} \times 3\frac{1}{2} = 11 \text{ in.,}$ the circumference; $11 \text{ in.} \times \frac{1}{2} \text{ in. } (\frac{1}{4} \text{ of } 3\frac{1}{2} \text{ in.}) = 1\frac{1}{2} \text{ sq. in.,}$ which $\times 4 = 38\frac{1}{2} \text{ sq. in., Ans.}$

12. To multiply the circumference by $\frac{1}{4}$ of the diameter, and the resulting product by 4, is, in effect, multiplying the diameter and circumference together; therefore, $24553 \text{ mi.} \times 7911 \text{ mi.} = 196612083 \text{ sq. mi., Ans.}$

Measurement of Solids.

¶ 236. 2. $196612083 \text{ sq. mi.} \times 1318\frac{1}{2} \text{ mi.} (\frac{1}{8} \text{ of } 7911 \text{ mi.}) = 259233031435\frac{1}{2} \text{ cu. mi., Ans.}$

3. $2 \text{ ft.} \times 2 \text{ ft.} \times '7854 = 3'1416 \text{ sq. ft., contents of one end, which } \times 20 \text{ ft.} = 62'832 \text{ cu. ft., Ans.}$

4. $18'5 \text{ in.} \times 18'5 \text{ in.} \times '7854 = 268'8 + \text{sq. in., contents of one end, which } \times 8 \text{ in.} = 2150'4 + \text{cu. in., Ans.}$

5. $4 \text{ ft.} \times 4 \text{ ft.} \times 9 \text{ ft.} = 144 \text{ cu. ft., which } \div 3 = 48 \text{ cu. ft., Ans.}$

6. $7 \text{ ft.} \times 3\frac{1}{2} = 22 \text{ ft., circumference; then, } 22 \text{ ft.} \times \frac{1}{4} \text{ ft.} = 39\frac{1}{2} \text{ sq. ft., the area of the base, which } \times 9 \text{ ft. } (27 \div 3) = 346\frac{1}{2} \text{ cu. ft., Ans.}$

7. $81 (9^2) + 16 (4^2) + 36 (\sqrt{81 \times 16}) = 133 \text{ sq. in., which } \times 72 \text{ in. } (18 \text{ ft. } \div 3 = 6 \text{ ft.} = 72 \text{ in.}) = 9576 \text{ cu. in.} = 5 \text{ cu. ft. } 936 \text{ cu. in., Ans.}$

8. $2'56 (1'6^2) + '81 ('9^2) + 1'44 (\sqrt{1'6 \times '9}) = 4'81, \text{ which } \times '7854 = 3'77777\frac{1}{4} \text{ sq. ft., and this } \times 12 \text{ ft. } (36 \text{ ft. } \div 3) = 45'333 + \text{cu. ft., Ans.}$

Gauging, or Measuring Casks.

¶ 237. 2. $36 \text{ in.} - 27 \text{ in.} = 9 \text{ in.; and } 27 \text{ in.} + 6 \text{ in.} (\frac{2}{3} \text{ of } 9 \text{ in.}) = 33 \text{ in., mean diameter; then, } 33^2 \times '7854 \times 45 = 38488'527 \text{ cu. in., which } \div 231 = 166'617 \text{ gals., Ans.}$

¶ 238. 3. $1 \text{ lb.} : 5 \text{ lbs.} :: 4 \text{ ft.} : 20 \text{ ft., Ans.}$

4. $\frac{1}{4} \text{ ft.} : 40 \text{ ft.} :: 175 \text{ lbs.} : 14000 \text{ lbs., Ans.}$

5. $2 \text{ ft. } 6 \text{ in.} = 30 \text{ in., and } 3 \text{ ft. } 4 \text{ in.} = 40 \text{ in.; then, as they would carry parts inversely as their distances from the bale, } 70 \text{ in.} : 30 \text{ in.} :: 200 \text{ lbs.} : 85\frac{2}{3} \text{ lbs.; and } 70 \text{ in.} : 40 \text{ in.} :: 200 \text{ lbs.} : 114\frac{2}{3} \text{ lbs., Ans.}$

7. $10 : 1 :: 60 \text{ in.} : 6 \text{ in., Ans.}$

9. $10 \text{ ft.} \times 2 = 20 \text{ ft., diameter of the circle described by the power, which } \times 3\frac{1}{2} = 754\frac{1}{2} \text{ ft., circumference; then, } 754\frac{1}{2} \div \frac{1}{4} = 3017\frac{1}{2} \text{ lbs., balanced by } 1 \text{ lb. power, and } 3017\frac{1}{2} \text{ lbs. } \times 120 = 362057\frac{1}{2} \text{ lbs., Ans.}$

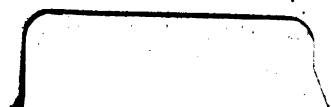
10. $10 \text{ ft.} = 120 \text{ in.; then, } 1 \text{ in.} : 120 \text{ in.} :: 1 : 120, \text{ Ans.}$

11. $231 \text{ cu. in. (1 wine gal.) } \div 4 = 57\frac{3}{4} \text{ cu. in. in } 1 \text{ qt.; then, } 231 \text{ cu. in.} - 57\frac{3}{4} \text{ cu. in.} = 173\frac{1}{4} \text{ cu. in., Ans.}$

12. $14 \text{ qts.} - 2\frac{1}{2} \text{ qts.} = 11\frac{1}{2} \text{ qts., which } \div 4 = 2\frac{7}{8} \text{ gal.; then, } 231 \text{ cu. in. } \times 2\frac{7}{8} = 661\frac{1}{8} \text{ cu. in., Ans.}$







VALUABLE SCHOOL BOOKS
PUBLISHED BY J. W. PRENTISS & CO.

EEENE, N. H.

ADAMS'S NEW ARITHMETIC—REVISED EDITION.

KEY TO ADAMS'S NEW ARITHMETIC, REVISED EDITION.

[Adams's New Arithmetic has undergone a thorough revision by its respected author, aided by several able scholars and teachers. It retains the characteristics of the former edition in a greatly improved form, with such corrections and additions as the wants of the times demand.]

ADAMS'S NEW ARITHMETIC, 12mo.

ADAMS'S NEW ARITHMETIC, 18mo.

KEY TO ADAMS'S NEW ARITHMETIC, 12mo.

JUVENILE LESSONS FOR BEGINNERS.

LITERARY AND SCIENTIFIC CLASS BOOK.

ADAMS'S SERIES OF SCHOOL BOOKS.

The publishers have in preparation, and will publish early this spring, the following series of School Books:

I.—PRIMARY ARITHMETIC, OR MENTAL OPERATIONS IN NUMBERS; being an introduction to ADAMS'S NEW ARITHMETIC, REVISED EDITION.

II.—ADAMS'S NEW ARITHMETIC, REVISED EDITION; being a revision of ADAMS'S NEW ARITHMETIC, first published in 1827.

III.—KEY TO THE REVISED EDITION OF ADAMS'S NEW ARITHMETIC.

IV.—MENSURATION, MECHANICAL POWERS, AND MACHINERY. The principles of mensuration analytically explained, and practically applied to the measurement of *lines, surfaces, and solids*; also, a philosophical explanation of the *simple mechanical powers*, and their application to *machinery*. Designed to follow ADAMS'S NEW ARITHMETIC.

V.—BOOK-KEEPING. This work contains a lucid explanation of the science of accounts, a new, concise, and common sense method of **BOOK-KEEPING** BY SINGLE ENTRY, and various forms of *receipts, orders, notes, bonds, mortgages*, and other instruments necessary for the transaction of business. Accompanied with **BLANK BOOKS**, for the use of learners.